Editorial

THE announcement that the Government will set up a Royal Commission on television confirms my opinion that we may not see any positive action this year.

Until the terms of the Commission are known it is impossible to say how much delay it will cause. Six months has been mentioned as a minimum time, but it will probably take longer than this.

It will please those people I referred to last month who are anxious to express their opinions on the financial and social implications of television. It will also give a breathing space to the Government, and possibly the Opposition, in committing themselves any further. On both sides it seems clear that too much was said too soon. It won't please those who thought the green light was about to flash.

As I write, the Labor Conference is re-considering the party's official attitude on nationalising television, and the Government is preparing legislation to amend the Labor Act which does not allow for private enterprise. The outcome of these things will set the stage for wordy encounter when next Parliament meets.

There can be no serious quarrel with the principle of a Royal Commission which, because of the impact television will have on us, is to be preferred to accepting reports or decisions of a Parliamentary Committee. It is also a safer procedure for the Government which is suffering from a sharp division in its ranks on the question, as is the Labor Party.

The danger is that a Commission will lose its value in unduly delaying what is at the moment an extremely awkward decision.

There is little doubt in my mind that any move to limit television to National stations is doomed eventually to failure. The issue is now much clearer—the ABC will undertake National television, and the commercials will also operate stations. I do not think a Labor decision to pursue its present anti-commercial policy can be maintained for long. Television may well be the first big nut which the firm socialists will fail to crack, and will pave the way for a broader party viewpoint on future issues.

Whether Labor will side-step a showdown and elect to consider the matter when Government legislation is brought down, is a guess at the moment. With the time-lag of a Commission in view it might be the wisest course, particularly with a chance ahead of gaining more seats in the Senate.

All this supports my view that there will be at least a year in time and millions of words before us before things start to move. If we allow another 18 months for television to be introduced—and then gradually—simple arithmetic doesn't give much hope that this estimate can be reduced.

The present march of events emphasises why I for one have never been able to agree that the approach to date of the television corner is much more than a mirage.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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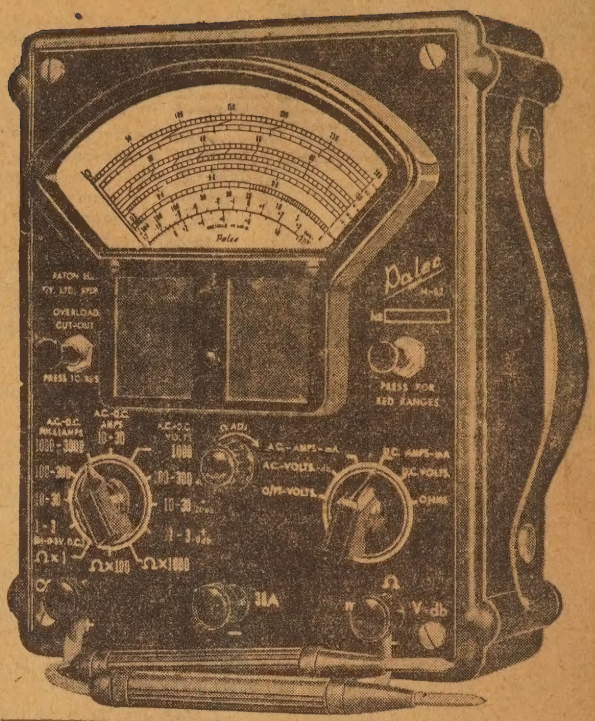

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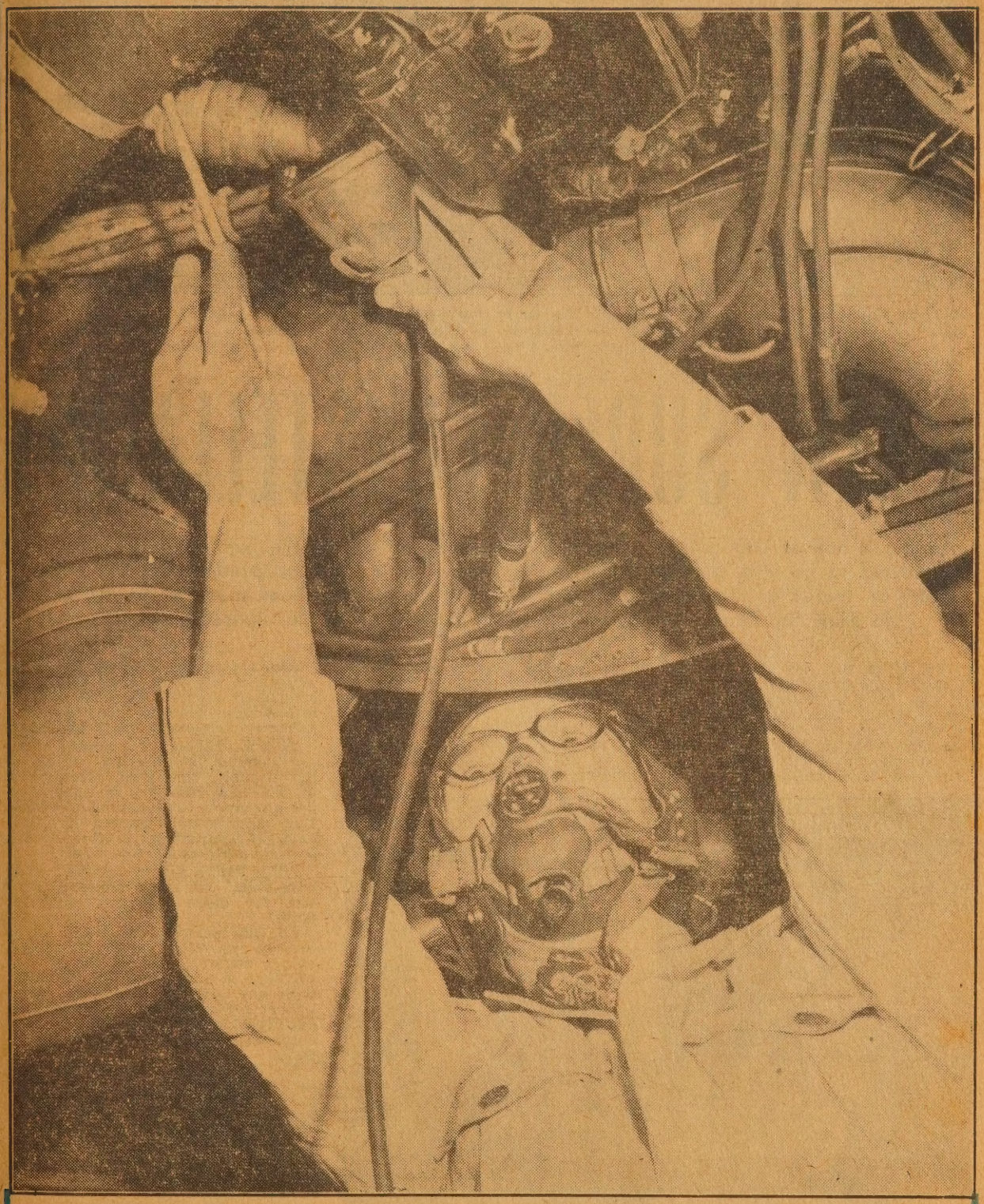
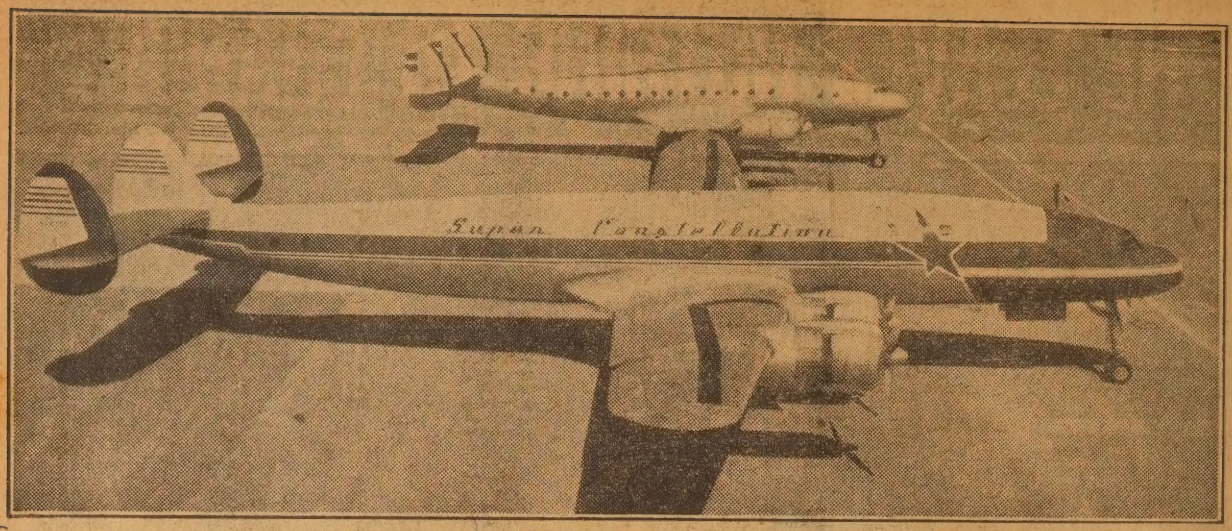


A conscientious pilot? No, you're wrong! Alec Winterson, better known among his workmates as "Dr." or "Stethoscope" Winterson has the job of checking delicate airplane control systems at the Bristol factory in England. Microphone and headset allow him to talk back to another engineer at the flight controls. Biggest job Winterson has tackled to date was on the mighty "Brabazon."



The Super Constellation is nearly twenty feet longer that the original Constellation shown in the background. The lates' has a completely re-styled interior and envisages the ultimate use of turbo-prop motors which are, as yet, still on the boards. Larger, rectangular windows replace the round ports and give much improved visibility.

A NEW SUPER-CONSTELLATION

America's newest and biggest airliner, an advanced version of the Super Constellation, is scheduled to go into operation soon in Australia. It can be adapted readily for either luxury or tourist or intermediate traffic, while the airframe has been specially strengthened to allow for future use of more powerful motors and higher operating speeds.

ALTHOUGH the airplane is the fastest and longest-ranged transport ever built in America, and the most elegant, Lockheed designers said they worked extra hard on its economics—vital in the international race for air travel leadership.

The new Lockheed, an advanced version of the Super Constellation, provides several interiors which can be quick-changed from high luxury to high density. Within one fuselage the convertible design incorporates all the flexible facilities needed for profitable operation under changing traffic conditions.

A corner of the lounge, which can be varied in size and appointments to accommodate up to 8 persons in semi-privacy. Side partitions can be added, if required to form private compartments. Note the murals and the contrasting trimming and color scheme.

Also it promises progress in power and speed, with 350 mph plus turbo-compound engines now, changeable to 450 mph turbo-prop power of the future—when engines are available.

Hall L. Hibbard, Lockheed vice-president of engineering, in opening to public view a full-size replica of the new interior, revealed that the airplane's combination of versatility and growth assured it a decade of leadership on the dollar-earning airlines of the world.

"It is many planes in one," Hibbard said. "It offers improved service for passengers and operators both."

For the passenger, the high-style interior provides such innovations as six separate cabins, for greater privacy; a mid-plane lounge plush with fine paintings and low-backed leather sofas; redesigned chairs with disappearing arms and built-in head cushions; and rich-grained wood walls.

For airlines, its convertibility and long-range ability to avoid non-revenue stops add up to fleet flexibility for any travel job, Hibbard declared. Passenger accommodations can

be shifted from a 47-seat maximum luxury plan, to a 59-seat standard version, or up to a 99-seat air coach.

The touch-of-tomorrow interior, a project that required two years of engineering, was developed to fit the enlarged fuselage of the world's first turbo-compound airliner. Measuring 18.4 feet longer than the original Constellation, the latest big-sister ship with its 20 pc more powerful engines is expected to set point-to-point speed records throughout the world when it enters airline service next year.

Turbo-compound engines (a piston type with auxiliary exhaust turbine), will give Super Constellations a cruising speed of about 350 mph over extended ranges and a top speed approaching 400 mph, engineers reported.

GREATER SPEED

A potential for even more speed has been pre-designed into the big planes. It has structural strength to take 450 mph turbo-prop engines (jet turning propellers) if they develop in years ahead, Hibbard said.

It will compete on about even terms, or better, with today's shorter-range pure jets, he added, and will be an efficient complement, especially with turbo-props, to speedier jets being planned.

Hibbard said the new interior is a "first taste" of further air-travel refinements due in the future as speeds, capacities, and fuselage lengths increase.

He summed up the situation like this: To give increased space sought by airlines, modern planes are being built longer. Space must be gained principally by length instead of width, for transports must be kept relatively slim and needle-shaped for higher speeds ahead.

That needle shape makes the job of beautifying an airliner as difficult as turning a corridor into a parlor, engineers agreed.

To help solve the corridor problem and to contribute ideas accumulated in 20 years of making famous ships and trains, both luxurious and livable, Lockheed called in Henry Dreyfuss, New York and Pasadena industrial designer.

Lockheed management complicated the task by insisting that the finished product must be convertible quickly from luxury to coach, and back again, and have a wide choice of floor plans.

Designers made seats, cabin partitions, galley and coat closets removable. Seats can be quickly respaced. Each set of chairs rests on concealed tracks running the full length of the plane, even under the galley.

A section of the main cabin, fitted with standard high-backed seats. The interior of the plane is actually 76½ feet long and may be divided into as many as 6 cabins. Passenger complement ranges from 47 in the de-luxe arrangement to 99 as an air coach.

By having several compartments, the forward, main or rear cabins as well as the lounge can be closed off. Thus a single plane could have first, second and third-class accommodations, a plan seriously considered by some world airlines.

MANY IMPROVEMENTS

In seeking a "comforts-of-home" atmosphere, Lockheed provided:

1. Greater privacy by partitioning and by making small cabins available for reservation.

2. Reduced noise.

3. Two passenger doors for easier loading.

4. Doubled lavatory facilities.

5. Walnut panelling between cabins, leather trim or over-all upholstery, "earthy" colors in familiar darks and warm lights, heaxy-textured seat fabrics, wall-to-wall carpeting, and a sweeping flow of design, free of square corners.

6. Fine arts, mural maps, and custom etchings in decorative screens and light shields.

7. Improved flight chairs with wing-type headrest, removable centre arm, 38-degree recline in most models, 68-degree in some.

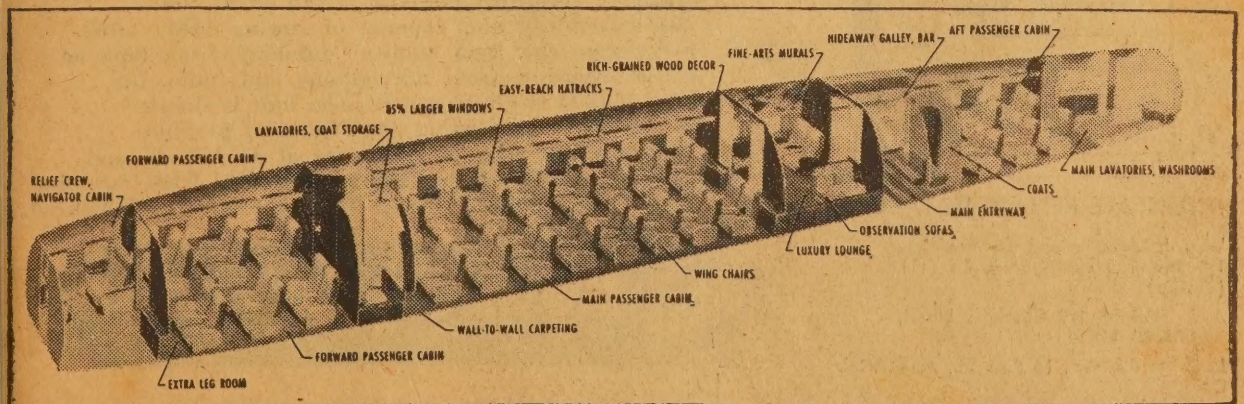
8. Hidden mechanical apparatus—lights, call buttons, oxygen plugs and other passenger conveniences visible only from the seat; ventilators and loudspeakers concealed.

9. Larger windows for more visibility; tinted green to block high-altitude glare.

10. Elimination of the "street-car look" by smoothing out the ceiling and installing built-in, diffused lighting.

KLM Royal Dutch Airlines will be the first to take delivery of the new plane with the new interior and the new engines. Service on KLM will

(Continued on Page 19)



Illustrating the internal arrangement of the "standard" 59-passenger version, with three cabins and a luxury lounge in addition to galley and toilet facilities.

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"BETATRON" GIVES RAYS TO ORDER

For years, scientists tried to build a machine which could produce high-energy electrons by means of a magnetic field. They wanted these electrons—with energies of millions of volts—both for direct use and to create equally high-energy x-rays, which would have many uses.

THE object was accomplished July 15, 1940, at the University of Illinois in the American Midwest, by Professor Donald W. Kerst. His first machine produced 2,500,000-volt x-rays.

He named it "betatron" from the Greek symbol, "beta," used scientifically to indicate high-energy electrons, and the suffix "tron," meaning "an instrument for." The betatron is "an instrument for produeing high-energy electrons."

In 1941 Professor Kerst completed his second betatron. It is the prototype of the 24,000,000-volt commercially-made betatrons now used for industrial radiography, for cancer treatment, and for scientific research. It can produce either x-rays or a free beam of electrons. Precise control of the energy is an important feature of this type of machine.

LARGE TYPES

A 340,000,000-volt betatron for scientific research, designed and built under Professor Kerst's direction, went into operation February 15, 1950, at the University of Illinois. This machine involves great refinements of design. Construction of an 80,000,000-volt "pilot model" preceded building of the big machine. It was completed in 1948.

The 340,000,000, 80,000,000, and 24,000,000-volt betatrons are now operated in the Physics Research Laboratory on the campus of the University of Illinois. This building also contains laboratories, shops, and offices for the staff doing research with them, and the original 2,500,000-volt betatron of 1940 is on exhibition there.

A betatron operates on the principles of an alternating current electric transformer. This type of transformer changes one alternating voltage into another. The explanation of how it operates rests on the fact that an electric current can create magnetism, and conversely, that magnetism can create an electric current.

TRANSFORMER ACTION

This can be demonstrated by winding two coils of wire around an iron bar. If a current is sent into one coil, causing the bar to become a magnet, the second coil also will have a current flowing through it during the time the bar is becoming magnetised.

This flow occurs only during the time the bar is becoming magnetised, or is losing its magnetism. It is caused by the force of the magnetic change, which pushes electrons along on the wires.

The voltages of the two currents are related directly to the ratio of turns of wire in the two coils. If the primary has 10 turns and the secondary 100, the voltage from the secondary will be 10 times that fed into the primary.

Space and insulation problems limit the number of turns which can be put into a secondary coil. The betatron gets away from these limitations by replacing the coil of wires with a ring-shaped vacuum tube.

Electrons, instead of flowing along wires, spin around inside this tube. The ratio of the turns they make is such that they attain an energy of 24,000,000 volts.

On a wire coil secondary, the electrons are provided by the atoms of the wire. For the vacuum tube, the electron source is a heated filament. This filament, inside the tube, is part of a device called an "injector." A pulsating voltage to it throws electrons from the filament into the vacuum.

ENERGY PULSES

The pulsations are synchronised with the alternating current of the primary coil so that electrons are injected just as the magnetism is ready to push them around.

The path of the electrons, inside the 19-inch vacuum tube, is approximately 1-25in wide. They circle around in this path until they reach maximum energy. Then they strike a pin-point of platinum located on the injector.

When high-energy electrons hit such a "target" they create equally high-energy x-rays, which come out of the vacuum tube in a straight, piercing beam. Or by means of special devices, the electrons themselves may be brought out of the tube in a compact beam.

The x-rays, or electrons, do not, however, come out continuously. They come in "pulses" or "bursts," one at every peak in the 180-cycle alternating current of the primary coil.

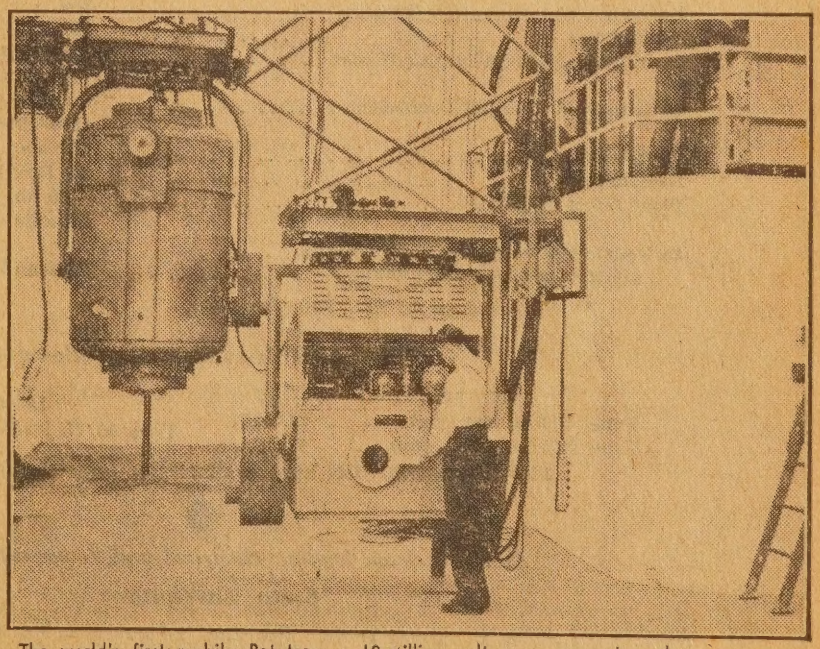
In discussing a transformer it is simple to describe it as two coils of wire around a bar of iron. Often, however, more complicated shapes are more efficient. One of these has top and bottom bars joined by three vertical "legs."

This is the pattern of the betatron. The primary coil is wound around the centre leg. It is in two parts, one located at the top and the other at the bottom of the leg. The ring-shaped vacuum tube, taking the place of a secondary coil, is between the two parts of the primary coil.

On the 24,000,000-volt betatron, the centre leg is cut across at the point where the tube is located. This is to allow the magnetism not only to push electrons around inside the tube, but also to have it perform another task, which is to keep the electrons in their orbit inside the vacuum tube. Through careful design of the machine, it does this exactly.

The 340,000,000-volt betatron

(Continued on Page 9)



The world's first mobile Betatron, a 10-million volt x-ray generator whose rays are capable of penetrating 16 inches of steel, is checked in a special building in which it is housed at the US Naval Ordnance Laboratory. At the left is the 2-million volt generator, in the centre foreground is the Betatron itself while at the upper right is the instrument panel. Special feature of the equipment, built by the G. E. Company is that it can be aimed in any direction.

E. M. I. MAGNETIC RECORDING TAPE

IS NOW AVAILABLE WITH HIGH COERCIVITY COATING

"EMITAPE," the result of many years' research at E.M.I. Factories Ltd., England, makes possible the attainment of wide range recording at slower tape speeds.

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- **Signal/noise ratio*: 60 db (unweighted) below peak recording level (2% total harmonic distortion) measured over a band width of 50-15,000 c.p.s.**

HIGH COERCIVITY EMITAPE
TECHNICAL DATA

Thickness	
Backing	.0016"
Coating	.0005"
Total	.0021"
Tape Width	.25" + 0 —.004"
Tensile Strength	4½lb per ¼" width.
Elastic Elongation at 1lb	Less than .5%.
Recommended Operation Tension	3oz.
Yield Point	4lb.
Longitudinal Humidity Coefficient	8 x 10 - 3% per % R.H. (40—95% R.H. at 77°F.)
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Coercivity	270 oer.
Remanence	.50 flux lines per ¼".
Print Level at 15"/sec.	—60 db. for 5 minute contact and instantaneous playback at 65°F.
Instantaneous variation in Sensitivity along tape length-maximum	Plus and minus 1½ db.

* *Measured on an EMI Tape Recorder.*

"EMITAPE" is available as follows:—

HC COATING	LC COATING
Type H60/6 600' reels £1/14/6	**Type 65/12 1200' reels £2/18/-**
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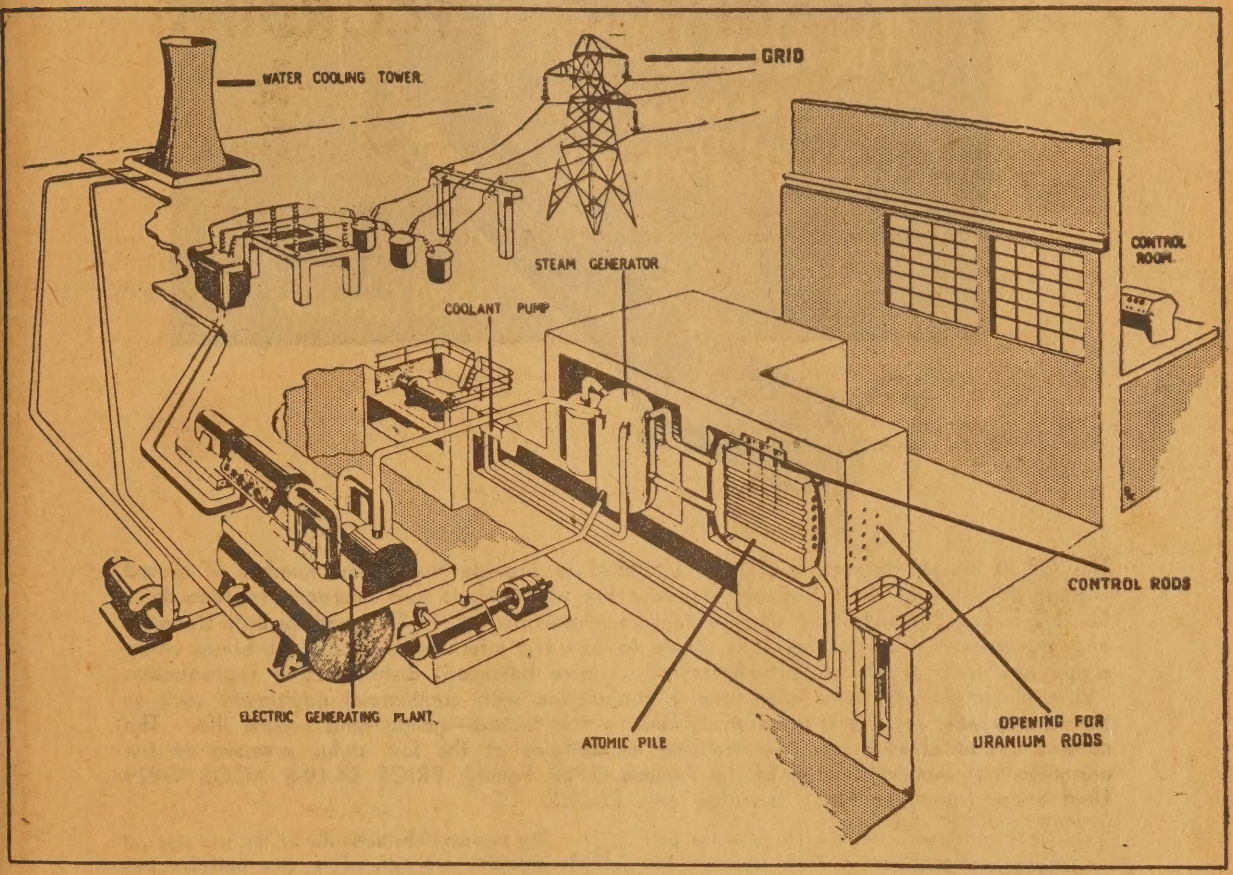
Western Australia: Wyper Howard Ltd., 671-3 Hay St., Perth.
Queensland: A. E. Harrold, 123-125 Charlotte St., Brisbane.

PLANS FOR ATOM POWER STATION

This diagram, which was part of the British Ministry of Supply's display at the recent Preston Guild Industrial Exhibition, Lancs, shows the research workers' conception of the Atomic Power Station of the future.



Scientists of the Atomic Energy Research Establishment at Harwell, who are at present working on the project, have prepared this theoretical picture illustrating how electricity might be produced in an atom-powered generating station.

It shows how heat from an atom pile could be used to produce steam which, in turn, would drive the dynamos to produce electric current. This method is now being investigated in research at Harwell.

Scientists estimate that the atomic fuel in such a plant would not have to be replaced for 15-30 years, and consumption of coal by British power stations is increasing so rapidly that 13,000,000 more tons may well be required every year by 1960.

In an atomic power station, the present coal and coke furnaces would be replaced by atomic piles.

The resultant savings in these fuels would thus make an important contribution to the country's economy.

It is expected that an experimental unit will soon be built which will foreshadow the first atomic power station.

"BETATRON" GIVES RAYS TO ORDER

(Continued from Page 7)

operates in the same general manner as the 24,000,000-volt, but its size permits certain changes. One is that the centre leg is not cut. The magnetism from it is used only to push the electrons. This greatly reduces power requirements of the primary.

To keep the electrons in their proper path inside the ring-shaped vacuum tube, a ring of "orbit" or "focusing" magnets is located around the centre leg. Each is shaped like the letter "C" and faces inwards. The big vacuum tube passes between the points of the "C's." This ring of magnets was carefully designed and built so that it produces a perfect circular magnetic field.

The big betatron differs, also, in another respect. Its magnet is "biased." This means that there is a special coil which magnetises the iron in a direction opposite to the magnetism to be used in accelerating electrons. When the primary current begins its efforts, it must overcome this force before going on to the peak of its cycle.

The result is that the magnetism of the iron rises not just from zero to full force, but all the way from an opposite condition to the desired full. Since it is the time during which magnetic force is increasing that accelerates electrons, this gives the electrons a much longer, stronger push during each of the six-pulses-a-second rate at which the big betatron operates.

Cosmic rays of great energy come to the earth from outer space. The atmosphere screens out most of these so that only a few actually come down to the levels where human beings live. In the past, scientists studying the rays and the effects of their high energy have had to travel to mountain tops, or to use balloons to send instruments into the stratosphere where the rays are more plentiful.

The 340,000,000-volt betatron is

(Continued on Page 83)

Here it is...

The GP 30 crystal turnover pick-up is intended to provide the largest number of record enthusiasts with the best possible reproduction of standard and microgroove records. So this pick-up satisfies four all-important requirements: ● It will reproduce both standard and microgroove records. ● It is simple to operate; a turn of the front knob brings either stylus into use. ● The output characteristics give balanced, distortion-free reproduction with minimum surface noise when used in conjunction with commercial equipment such as the normal radio set. ● It is extremely kind to the record—giving long record life. The careful design gives exceptional tracking capabilities at the low stylus pressure of ten grammes. A Junior Member of the Famous GP20 Family. PRICE £4.19.6 ACOS GP29 Dual Stylus (turn-over type) cartridge only £2.19.6.

THE GP29 cartridge is designed to give the best possible reproduction of both standard and long playing records under home conditions with the normal run of domestic radio sets. No input correction is required apart from exceptional cases. The usual tone control on the set could provide additional adjustment to suit individual taste, but is not essential. The output of about .7 volt at 1,000 cps from standard and about half that from Long Playing records is right for present day requirements. The difference between the two output levels is no greater than variations found between individual records of the same type and is no more noticeable in use.

The response characteristic of the two sides of the cartridge are tailored to give optimum performance in both cases. The "standard" side gives a falling characteristic beyond 5kc. The bass end is compensated to within around 3dbs at 70cps. The result is well-balanced reproduction suggesting wide range but no or very little needle scratch. Long playing records with their softer and smoother surface require no top cut except to compensate for pre-emphasis in recording. The cartridge takes two sapphire-tipped cantilever styli which are held in the needle chuck by a set screw. They are easily replaceable when so required in service.

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CAN WE BLAME THE SUNSPOTS?

Enthusiastic statisticians have proved that sun spots both increase and decrease the birth rate, improve and ruin the crops, cause both war and peace and generally control the moon and ourselves. It seems unlikely that these tidal waves of flames and vaporised elements in the sun are so potent after all.

by Professor A. M. Low

THE flying saucers which many people claim they have seen may be due to spots before their eyes, but sun spots are real enough and have now been observed for many years.

These observations suggest that the spots, really gigantic tornadoes perhaps 50,000 miles across, come and go with a periodic rhythm. There may be sun spots in any year, but the spots are more numerous, and perhaps bigger, in some years than in others.

The intervals between the period of maximum sun spot activity appears to be about eleven years, and hence we talk about the sun spot cycle.

LOOKS VERY SMALL

To the naked eye looking through smoked glass for protection, a sun spot appears only as an insignificant dark mark on the face of the sun. It is in fact probably larger than the earth, a sort of continuously exploding H-bomb representing activity and energy that make the atom-bomb like a pop-gun.

It is fortunate that the activity is taking place 93,000,000 miles away or the effects on the earth would be very great. As it is, a period of great sun spot activity is extremely bad for radio and television and may interrupt long-distance radio-communication altogether for hours and even days together.

The visible effects of sun spot activity on the earth may be unusually brilliant displays of the "northern lights," signs of violent magnetic storms.

Sun spots are a nuisance to radio engineers, but do they have an effect on the earth more important than the spoiling of wireless reception? There are people who believe that sun spots profoundly influence every sort of human activity, either directly or indirectly.

FACT OR FANCY?

The speculation has been so extensive that it is difficult to separate the facts for which there is some evidence over a long period and the speculations which are logical or plausible, but are not firmly established by independent evidence. The subject is a fascinating one and as evidence is gathered over the course of decades the people today who suggest that sun spots virtually control the destiny of the world may be less foolish than they seem.

Sun spots could affect the earth and its inhabitants in a number of ways. We do not really understand how "weather" originates. We can forecast the way cyclones and anti-cyclones develop, but know little of their time and origin.

There is some evidence that they originate far up in the earth's atmosphere and if this is the case they may depend on magnetic forces, the disturbance of which by sun spots is firmly established. In a nutshell, sun spots may cause great variations in the amount of rainfall, cloud and sunshine.

Working on this thesis many scientists have produced evidence that the sun spot cycle coincides with the rainfall cycle. They have shown over a course of years, for instance, that the rise and fall in the level of Lake Victoria Nyanza can be correlated with sun spot activity. The variations of plant growth in many different places have also been stated to coincide with variations in sun spot activity.

Variations in rainfall, surface temperature (averaging about one degree less during periods of sun spot activity) and cloudiness can have far-reaching effects on all kinds of activities and, therefore, sun spots may, indirectly, affect human beings.

For instance, some years ago an expert in Ceylon said that he had found a correlation between sun spot cycles and epidemics of malaria. Sun spots produce conditions favorable to the breeding of the malarial mosquito. Malaria saps the energy and health of hundreds of millions in the East, and, therefore, there may be a cycle of activity and prosperity based on the sun spot cycle.

Certainly these weather conditions affect the breeding and migration of animals and naturalists have traced all types of cycle in this connection which might be attributed to conditions resulting from sun spot activity.

They have measured the numbers of rabbits in given areas, the number of fur-bearing animals trapped, the catches of salmon and many other tests of activity among animals and have built up examples showing there are cycles which, if they do not coincide exactly with the sun spot cycle, are dependent upon it.

Others argue that sun spot activity means very much more than mere difference in the weather. Sun spots cause variations in the amount of ultra-violet and other radiation reaching the surface of the earth. These variations have been examined spectroscopically, and may have a far greater effect than is generally believed.

We know the relationship of sunshine with rickets, that fruit can be ripened more quickly under ultra-violet rays and that the quality of food, as distinct from the quantity, is affected by sunshine. Now it is argued that the effect of variations in the amount of radiation must have far-reaching effects on the quality of crops of every kind even more important than on the quantity.

It is suggested that these variations cause changes in the moods and temperaments of human beings, difficult to trace in a single person, perhaps, but confirmed by past events.

1870 (the Franco-Prussian War), 1892 (beginning of a world slump), 1903 (Russo-Japanese War), and other dates allowing maximum sun spot activity are quoted in support of this theory. It is interesting to note that a book, published in 1937, said, almost unbelievingly, that if we considered sun spots as a cause of wars, then we must expect trouble in the latter half of 1939!

EFFECT ON HEALTH

Others have gone further and have offered detailed statistics to prove that sun spot activity produces more trouble from the incidence of appendicitis to the number of suicides. The basis is that meteorological disturbances, in the widest sense, put an increased strain on the human body, which is reflected in an increase in the mortality and disease rate.

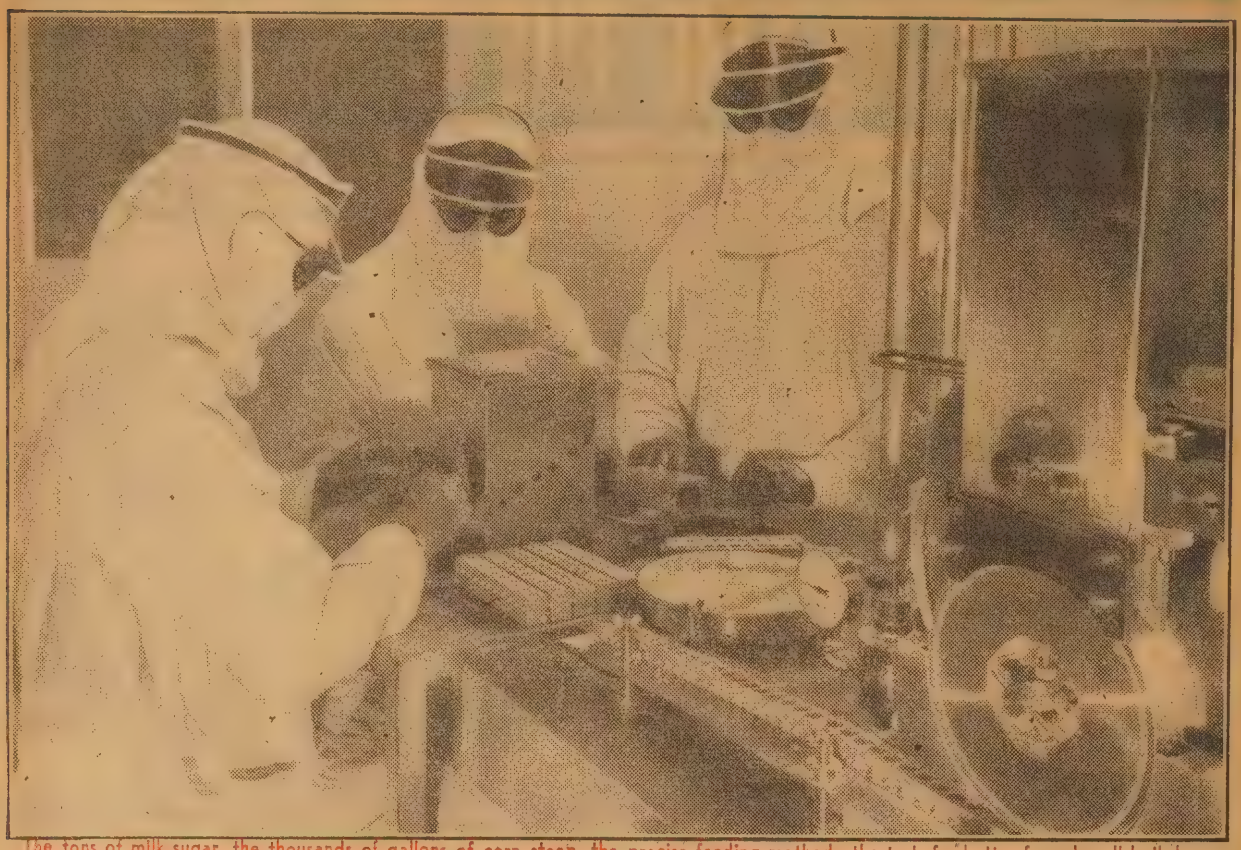
This, it is said, does not mean that death and disease rates read a "peak" every 11¼ years, but rather that improvements are temporarily checked. And, of course, the invention of a drug such as penicillin might well produce good effects far outweighing the harmful influence of sun spot activity.

It is the many factors involved that make it difficult to produce really acceptable scientific evidence. Mere coincidence is not sufficient proof. We must have evidence that the effect not only coincides with the cause, but that it cannot be attributed to any other cause.

Some scientists have endeavored to establish some relationship between business cycles and sun spot activity. Their argument is that economic prosperity is ultimately dependent upon crops of many different kinds and might be therefore expected to wax and wane in sympathy with sun spots.

There is also a psychological aspect —sunshine makes men cheerful and optimistic, dull days and a "heavy electrically" charged atmosphere depress them and influence their business decisions.

Statistics have been produced to show the world's major trade depressions in the past coinciding with the sun spot cycle. Unfortunately there are one or two awkward "slumps" and "booms" that do not fit neatly into the picture and most people will accept the conclusions with great reserve.



The tons of milk sugar, the thousands of gallons of corn steep, the precise feeding methods, the tests for better formulas all boil down to this. It takes thousands of gallons of broth to yield a few precious ounces of dry, sterile penicillin powder, the final packaging of which is done under ultra-violet light. The packagers are dressed "to the eyebrows" to protect themselves from the strong rays.

MORE ABOUT MAGIC MOULDS

The lowly moulds which contaminate our bread and cheese, jam and tomato sauce are more respected by scientists today than ever before, because it is always likely that they may contain some life-saving substance of benefit to medicine and man.

by Calvin Walters

SINCE the discovery of penicillin an extract obtained from a common mould, great interest attaches to any mould which comes the way of an enthusiastic investigator.

At one time the moulds were nothing but a curse to bacteriologists. These moulds had a nasty habit of contaminating the culture plates and test tubes in which were growing certain bacteria for the purposes of diagnosing a disease or the making of vaccine for treatment.

AGAR METHOD

The methods of growing bacteria include the use of a type of seaweed called agar. This substance when mixed with water forms a fine, hard jelly which, when mixed with nutrient substances, such as beef broth, white or yolk of egg, glucose, blood, &c., forms a most suitable nutrient food for the growing of bacteria.

Oh, yes. Germs are very fussy individuals when it comes to dinner time. They won't accept just anything, but must have nothing but the best.

The nutrient jelly is sterilised by heat and poured into sterile test tubes or special covered glass dishes called Petrie plates.

Now, when it is desired to isolate a certain germ from any substance, some of this substance is rubbed on to the surface of the Agar jelly, and the tube or plate put into an incubator and kept there at body or other suitable temperature for some hours.

Soon small dots will appear on the surface of the jelly, which later develop into well defined shapes, colors and sizes. There may be a conglomeration of dozens of each of these different dots, each of which contain millions of single bacteria or germs.

Among these "colonies," as they are called, will almost certainly be some moulds which, if allowed to develop, will quickly spread over the surface and render the isolation of any particular colony of germs very difficult, if not impossible.

IDENTIFICATION

Before this happens, however, the experienced eye will take a glance at the surface, and note which kind of colony is the most numerous. It will, in most cases, be possible to say what kind of germ it is merely by the appearance of the colony, noting the size, color, peculiarities of growth, &c. But, to be positive, it is necessary to examine under the microscope.

Accordingly, one of the colonies is touched with a sterile platinum wire,

transferred to a glass slide and spread over the surface, after diluting with a drop of sterile distilled water.

After a minute or two the film will be dry, and is then strained by various processes, the most common of which is that devised many years ago by Hans C. J. Gram, called Gram's method.

Briefly, the method consists of covering the slide with a watery solution of a violet dye called gentian violet. This is allowed to stand for about three minutes and is washed in distilled water. A red dye called Eosin is now applied. In a minute or two the slide is washed in alcohol two or three times and then examined under the microscope.

DYE INDICATOR

Not only does the dye bring up the shape and size of the germ, but it indicates whether the germ is "Gram positive" or "Gram negative."

These are very important terms to remember because some mould extracts are only effective against the Gram positive germs and some only against the Gram negative.

A Gram positive germ is one which retains the violet dye after washing in alcohol. A Gram negative germ is one which does not retain the stain, which will be washed out by the alcohol.

Having established whether the germs are pathogenic or disease-producing, it can be assumed that these are the germs which are causing the trouble in the patient, because they were the most numerous on the culture plate.

If a vaccine is to be made, and since the advent of the penicillins and other mould products, vaccine therapy is going into the discard. A series of test tubes containing agar are used, and a separate colony is taken from the plate and rubbed over the surface of the agar. This is incubated as before. Thus a pure culture of the germ is obtained from which a vaccine can be made by washing the germs from the surface with a special saline solution and the germs killed by heat or other specialised means.

CONTAMINATION

Sometimes, however, the plates and tubes become contaminated by dust which may drop into them from the air. It is then that the moulds begin to grow, and endless trouble caused the bacteriologist by this contamination. It may become necessary to start all over again, but whereas in the past it was customary to just wash the plates and tubes amid a good deal of cursing and good slang in some suitable language, nowadays no plate with mould is washed away without first examining it to see what effect the mould has on the colonies of germs also growing on the plate.

Scientists remember that it was just like that that penicillin was discovered.

Most of the diseases which afflict mankind are caused by the Gram positive germs, and up to the advent of penicillin great reliance was placed on the use of those wonder drugs, the sulphonamides.

These are chemicals derived from the by-products of coal tar manufacture and include quite a host of chemicals such as sulphadiozone, sulphapyridine, sulphanilamide, sulphathiozole, sulphadiazine, &c., each of which is exceedingly useful in certain specific infections.

The sulpha drugs are particularly effective against gram positive germs and ineffective against gram negative germs. They seem to act by constructing a chemical wall around the bacteria, which deprives them of the necessary nutriments for their existence and multiplication.

They are thus subject to a process of starvation, and are so weakened that they become powerless against the defensive action of the human body. The germs are not killed outright by the sulpha drugs.

Sulpha drugs are particularly effective against meningitis, pneumonia, dysentery and diseases caused by the staphylococcus and streptococcus bacteria, such as tonsilitis, boils, carbuncles, blood poisoning, &c.

Unfortunately, the sulpha drugs are somewhat toxic when administered wrongly and may cause some reaction.

The discovery of penicillin was a most remarkable advance, as here we have a substance which is not only effective against gram positive germs, but is free from the toxic effects encountered with the sulpha-drugs. It is also effective against some germs where the sulpha drugs are useless.

Penicillin is a substance produced by a green or blue-green mould sometimes found growing on bread, cheese and other foods, but it must not be assumed that every mould answering this description is a penicillin-producing mould.

There are two species of penicillin-producing moulds. One grows on the surface of the medium in which it is grown, and the other grows in the medium itself. The mould which grows on the surface is named NRRL 1249, B21. The other is called NRRL 832.

The production of penicillin is interesting. A brief outline of the method used will show that considerable progress has been made in the mass production of the drug.

MOULD SEEDS

The mould has a reproductive cycle, and at one stage it becomes covered with tiny spores. These are the "seed" of the mould.

These spores are needed for the cultivation of the mould, but the mould does not produce much penicillin while in the sporing stage.

The sporing mould is placed on the agar medium mentioned above and kept at room temperature of 75 degrees. Here it flourishes, and when sufficiently advanced it is transferred to tanks of sterile but nourishing medium.

The tanks are kept at 75 degrees, and in about 24 hours a fluffy, de-

Meet one of the Penicillin-producing Moulds. (The Moulds themselves are called Penicillin Moulds.) It's a greenish grey color, just like the ordinary mould you find on spoiled foods, but it requires more than ordinary food to keep it alive and growing.

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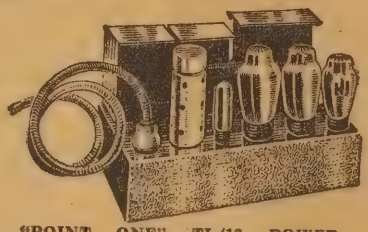

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licate growth is seen on the bottom of the tank. Three days afterwards the growth has reached the surface, where it throws out a network of fine threads called a mycelium, white in color.

On the fifth day the entire surface of the fluid in the tank is covered with this mycelium, which is quite dry and soon begins to turn a bluish-green in color. In seven days the growth is a compact mass, having the appearance of felt. The upper surface is water repellent, but the under surface is wet, brownish-yellow in color and slimy. The solution in which it is growing now begins to turn yellow, and this yellowish solution contains the penicillin.

TYPE OF NUTRIENT

The growth of the mould is very much affected by the type of nutrients which are used to feed it. Such substances as glucose, trypsin, brown sugar, zinc sulphate and manganese help to promote the growth of the mould.

But the most important discovery and that which more than any other made the commercial production of penicillin possible was that the addition of a small amount of corn-steeping liquor to the growing medium promoted the growth fifteen-fold.

When the mould has been producing penicillin for about seven days it becomes exhausted. At this period the penicillin is extracted from the medium.

The mould is removed from the medium and the yellowish liquid is left behind.

The amount of penicillin in the solution is remarkably small—only about 0.03 pc. Sixteen litres of the medium yields only about one gram of penicillin, so it can be seen that many gallons of medium are necessary for the production of penicillin on a large scale.

The process of extracting the penicillin from the solution is an expensive one.

The solution is concentrated by evaporation, but as heat will destroy the drug this must be done slowly.

After a preliminary concentration, the solution is put through a filtering or absorptive process. The penicillin is removed from the absorbers and concentrated still further. This is done by a chemical process using butanol—petroleum.

The drug still contains a proportion of water, and as penicillin is very unstable in solution it is absolutely necessary that the drug contains not more than 0.5 pc of water.

NO HEAT

Heat cannot be applied to the drug in any way so that the solution must be concentrated at a low temperature in a frozen state using a system of steam ejectors and mechanical pumps to dry the penicillin in a vacuum.

The removal of the last 2 or 3 pc of moisture is the most difficult feat. It takes as much time to drive off this last small per cent as it does to remove the first 97 pc.

One method of drying developed by the Radio Corporation of America uses radio frequencies. This is very fast. The bottles of penicillin are revolved at a very high speed while being subjected to the radio frequencies. Centrifugal force throws the drug to the walls of the bottles until the drying is complete. The drug can then be stored in a perfectly dry condition. The complete drying process by the former methods take up to 40 hours.

Penicillin is used in the form of salts, but can be obtained in the form of a free acid. The sodium and calcium salts are the two most commonly employed, and these are in a very pure state, so highly has the technique been developed.

Penicillin must be stored in a cold place. If subjected to temperatures of about 96 degrees Fah. it may become completely useless. If kept in a refrigerator it will last for about three months, but may lose some of its potency. It is safer to use the drug within two weeks even when kept on a refrigerator.

It has often been said by the lay public, "Why cannot penicillin be taken by mouth?"

The fact is that the drug is very sensitive to acids. The acids of the stomach can render the drug useless. It any case it must not be taken in orange juice or other fruit juices, but is better taken with milk which affords some protection from the stomach acids.

The chemical nature of penicillin has recently been established. It has a peculiar type of molecule, and attempts are being made to produce the drug synthetically, which, if successful, will considerably reduce its cost.

How does penicillin kill germs? Any one can kill germs in their bodies by swallowing carbolic acid. They will kill themselves at the same time. If penicillin is not harmful to the human body it is clear that it does not produce a disinfectant in the blood stream.

PENICILLIN ACTION

Germs must breathe and eat in order to live and multiply. A widely accepted theory is that penicillin deprives the germs of their food. A substance produced in our bodies is pyruvic acid. This is essential to both germs and humans. The human and the germ use this acid in different ways and penicillin deprives the germs of the capacity to use the acid in their way. Thus the pyruvic acid can still be used by humans but not by germs. This reduces the germs' capacity to multiply and thus they become vulnerable to the body's defensive processes. Another theory says that in addition to the above penicillin acts by depriving young germs of their oxygen supply.

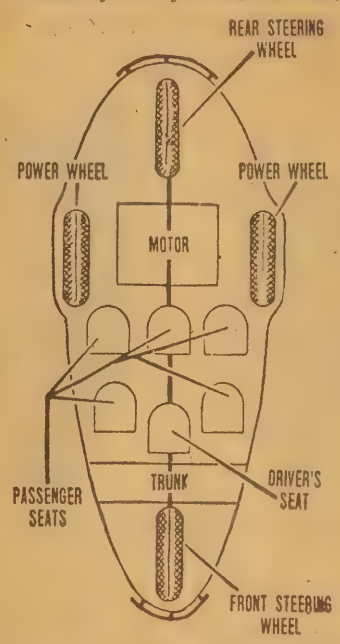
In the eight years since penicillin came into use it has saved perhaps millions of lives. A new science has developed in the study of moulds. New drugs of this nature are being found every day so that the lowly mould has now become a necessary adjunct to our society.

HE DOESN'T LIKE MODERN CARS

Curvaceous lines, masses of chrome plate and wide bench seats don't carry much weight with Gabriel Voisin, French car and aircraft manufacturer. Though, the public wants them that way, he still doesn't like it.

CARS should be more functional and scientific in their design, he maintains, and this means something like a flatiron mounted on wheels.

Seventy-two-year old Voisin, first man to instal a petrol engine in an aeroplane (in 1902), has recently condemned 1952 models as "murder cars." Their design was a generation behind the times.



"Eighty per cent of car accidents today are due to the technical faults of the cars," he said. "Manufacturers are interested solely in lowering the price of cars and have never made a serious effort to give the occupants of motor cars safety.

"Ninety per cent of these accidents are due to violating the natural law governing a moving body. The centre of gravity of a car is almost always incorrect in regard to the position of the wheels and the aero-dynamic pressures exerted on them.

"The 1952 models embody grave errors. A serious fault is the disposition of the car's weight. Heavy parts like the motor, the transmission and gearbox are placed at the front or rear. This results in catastrophe in the case of what should be a minor accident.

"The car rotates on itself, around its own centre of gravity, and thus deprived of steering-way, cannot be halted."

Voisin's ideal car would have no heavy bumpers, no hood in front or trunk in rear, and be much shorter than present models. It would carry four persons, weigh 500lb, and be about 16 hp. The centre of gravity would be extremely low and the motor bloc would be near the middle of the car.

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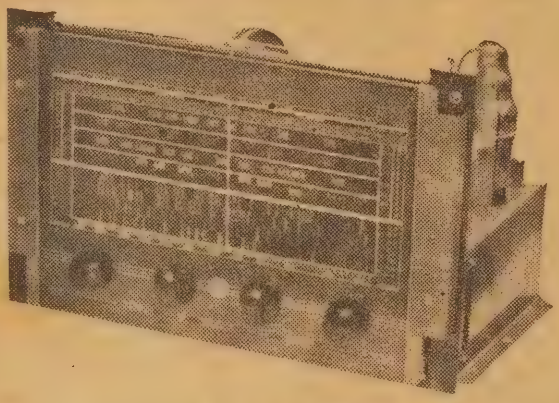

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Technical Review

PRINTED, ETCHED WINDINGS FOR POWER TRANSFORMERS

A British firm has for many years been working on a novel system of printed circuitry by which the pattern required is printed with a special ink on to a metallised film applied to an insulating base. The metal not protected by the ink is then removed by an etching process, leaving behind the desired pattern.

SINCE the first announcement much progress has been made, and the process, known as the Technograph System, has reached a stage where the production of complete radio apparatus, sub-assemblies and components is a practical proposition.

The latest system includes a recovery process for the metal removed in the etching bath, as this would otherwise involve a considerable wastage of valuable material and of the chemicals used for etching.

Where simple circuit patterns not involving crossovers are required, the patterns can be printed on a single metallised foil bonded to one surface of the insulating base, but where crossovers are inevitable a metal-insulator-metal sandwich must be used.

In this case both surfaces of the insulating plate, or sheet, can be metallised and the circuit completed by punching holes and inserting rivets at the appropriate points.

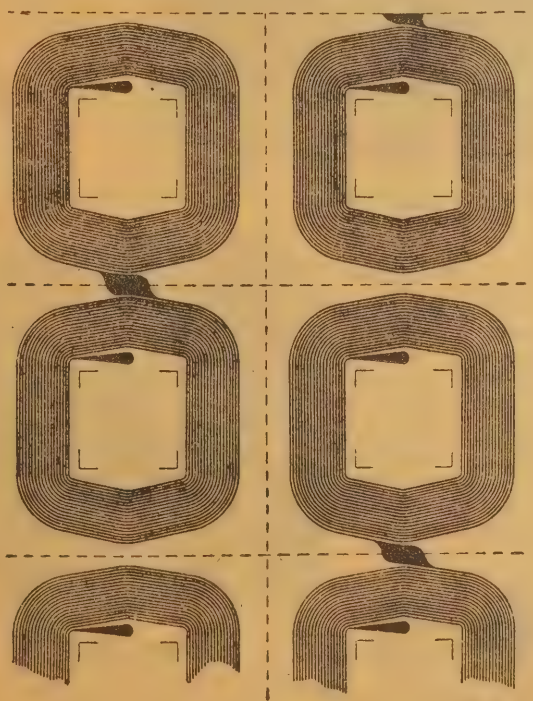
The Technograph System enables circuit patterns to be printed on foil bonded to flexible insulants, which can be produced in the form of a long strip or roll some hundreds of feet long, which may be cut and folded to build up the particular unit required.

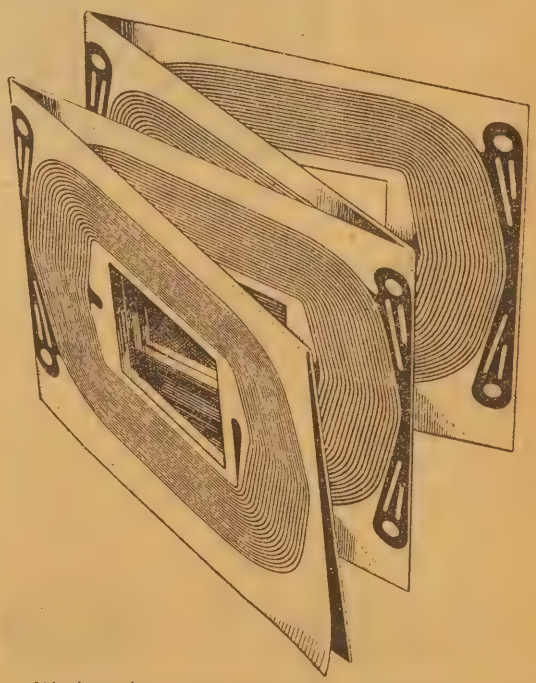
One application of this kind, unusual though it may seem, is the production of mains transformers. A section of a printed strip before and after partial folding is shown in the accompanying illustration. In the latter the centres of the plates have been punched out to form the core tunnel.

It is easy by this method of construction to grade the thickness of the "wire" to give thicker conductors on the inside and thinner on the outside, where heat radiation is greatest, to achieve a more even temperature gradient throughout the winding than is possible with normal wire winding methods.

This process is now being extended to armature windings on electric motors.

The company handling the system is Technograph Printed Circuits Ltd., 32, Shaftesbury Ave., London, W1, who have just issued a booklet describing the system. (Wireless World, Dec., 1952.)





Windings for a power tranformer are printed and etched on to a flat sheet, then folded, as shown. Parallel connections would presumably be used for current requirements too heavy for a single metallic layer.

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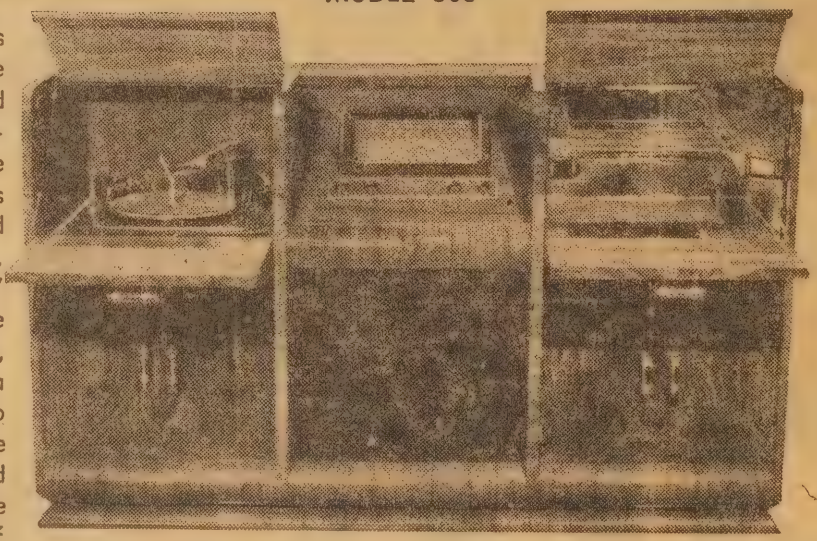
MODEL 508

Model 508 is suitable for all types of record changers.

Labyrinth baffle boxes suitable for 12" speakers to fit 508 cabinets are now available.

MODEL 511 is a high grade cocktail and radiogram cabinet suitable for all types of record changers. Made of 1" solid core Italian walnut, finished in a brilliant piano finish. Ample bottle and record space each side of speaker grill.



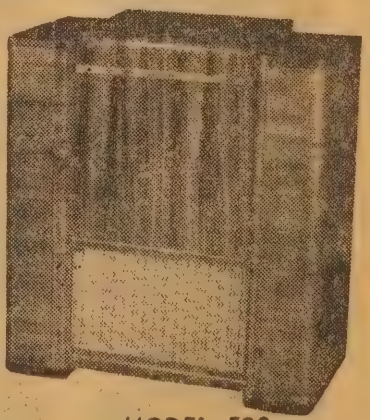
MODEL 511

Cocktail section lined with best quality glass mirrors.

Let Slade's Radio or any of their local dealers show you how cheaply you can convert your old radio into a modern radiogram.

Model 509 is suitable for single motors. Dial fits on front of cabinet, lid being lifted only for record playing.

High fidelity custom built 5 valve D.W. chassis specially built for microgroove or tape recording. Price with 12" Rola speaker £28/10/0 Nett. One Garrard RC65 RC70A, or RC75A record changer available with each unit.



MODEL 590

SLADE'S RADIO PTY LTD.

LANG STREET, CROYDON, N.S.W.

Tel. UJ5381-UJ5382. Established 30 years.

Expert packing for all out of town deliveries.

MEASURING CHARACTERISTICS OF TRANSMISSION LINES

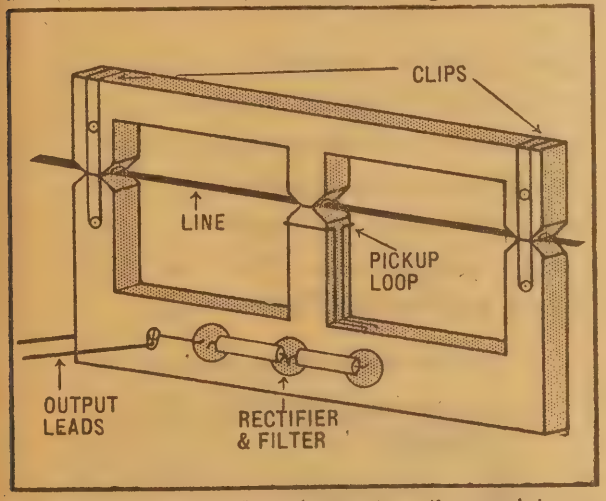
A new method of measuring the attenuation of balanced, unshielded transmission lines, such as those used in TV and FM receivers, has been developed in the high frequency standards section of the US National Bureau of Standards. The procedure is both simple and rapid.

BY using a grid dip meter and a microammeter, for example, results reproducible to better than 10 pc can be obtained. With more elaborate apparatus, attenuation accuracies to within 1 pc can be obtained, reproducible to 1/10 pc on uniform sections of line.

The apparent attenuation of unshielded, balanced, parallel conductor transmission lines is sensitive to the amount of radiation that occurs along the line. However, for frequencies between 30 and 300 Mc., external effects arising from the test apparatus, connectors, terminations and bends cause variations in readings.

Reliable measuring systems must either minimise the order of these external effects or evaluate them and allow for their quantity in the final result.

The NBS method for measuring unshielded lines is based on the fact that if a section of line a number of half wave-lengths long is resonated when both ends are shorted, the standing wave ratio at the receiving end will be greater than at the input end. Furthermore, the change in SWR is due only to the attenuation in the line.



Sliding probe used in the new NBS method for measuring the attenuation of balance transmission lines. The probe is designed to hold a small pick-up loop at a constant distance from the line. A rectifier and filter circuit is built in.

ATTENUATION

This fact makes it possible to determine the attenuation merely as a function of the standing wave ratio, that is, the ratio of the maximum to the minimum current in the line.

To avoid errors introduced by improper terminations, the test transmission line is rigidly fastened and held in tension by clamps made of low-resistance materials that also act as good short circuits to the electric field.

A coupling loop built into the input-end terminal loosely couples the output of a conventional power source to the line. A similar loop is part of the receiving-end termination, and its output is connected to a crystal rectifier and filter circuit.

The minimum and maximum currents (the standing waves) are detected by a sliding probe made of polystyrene foam or a similar material. The probe is designed to hold a small pickup loop at a constant distance from the line. In this way, irregularities in the line are compensated and, at the same time, the loop interferes as little as possible with the fields of the line.

An additional rectifier and filter circuit is also built into the probe.

The d-c leads from the probe and the receiving-end terminal networks are connected to a switching arrangement that controls a shunt on a sensitive galvanometer. The shunt is designed to permit maximum deflection for both maximum and minimum readings, to give critical damping to the galvanometer, and to provide a constant-output resistance for the filter networks.

In making a measurement, the galvanometer is first connected to the receiving-end terminal, and the generator frequency is adjusted to the resonant frequency of the line, as indicated by a maximum deflection on the meter. (If the measurement is to be made at a particular frequency, the line may be cut to a length equal to some multiple of the wavelength.)

The power source is then adjusted so that the amplitude of the detected radiation is at some convenient level, and the value of the galvanometer deflection is noted.

The galvanometer is then switched to the probe circuit through the shunt, and the probe is moved along the line, near the input terminals until a maximun current is indicated by the galvanometer. The generator frequency and the output power are adjusted to the original resonance and current values to compensate for the probe movement.

The deflection of the galvanometer and the position along the line of the probe at the point of maximum current are then noted. The same procedure is repeated for the minimum current position. The standing wave ratio is obtained from the values of the minimum and maximum currents, and from the SWR the attenuation is derived.

In order to obtain the standing wave ratio accurately, the probe-filter-circuits-galvanometer system must be calibrated at the operating frequency.

CALIBRATING PROBE

The probe is set at a convenient position near the input end of the transmission line — a point of maximum current. The input signal is then varied by known amounts of power, voltage, or current so as to effectively reproduce the standing wave conditions normally experienced by the probe as it is moved along the line.

The input signal is measured by conventional laboratory apparatus (calibrated attenuator or voltmeter), and the resulting galvanometer deflections are then calibrated in terms of the standing wave ratio introduced into the system.

The attenuation of the line is approximately equal to the arc hyperbolic cotangent of the standing wave ratio, a value that can be obtained directly from most hand-books of mathematical tables.

Although galvanometer and extensive generatng equipment are used for these measurements by the National Bureau of Standards, very acceptable results can still be obtained by using a low-power generator such as a grid-dip meter, as the signal source to be coupled into the line. Likewise, the standing waves along the line, detected by the probe can be measured by a sensitive microammeter.

A "SUPER" SUPER-CONSTELLATION

(Continued from Page 5)

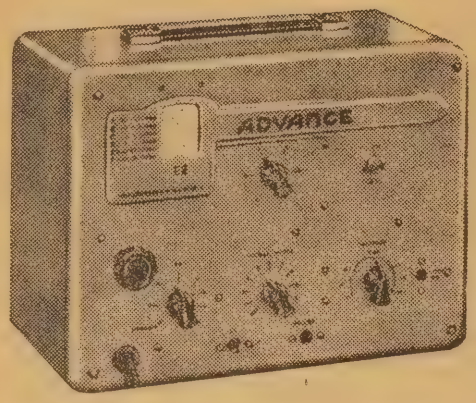
start in a few months. KLM has 13 on order, including four of the 94-seat immigrant models.

Next in line are Air France and Eastern Air Lines, both planning some modification of the basic interior chosen by eight other airlines. With difference in color schemes and minor appointments, the basic plan will be used by Air India, Trans-Canada Air Lines, Qantas Empire Airways, Braathens South American and Far East Air-transport, Aerovias Nacionales de Colombia, Iberia Lineas Aereas Espanolas, Pakistan International and Lineas Aeropostal Venezolana.

Ninety-six Super Constellations have been ordered by commercial lines. Production is assured well into 1954.

Twenty are already in service with standard engines can be converted to turbo-compounds for added speed.

Advance SIGNAL GENERATORS



R.F. GENERATOR TYPE E2

Range: 100 Kc/s to 100 Mc/s in 6 ranges on fundamentals.

Accuracy: Frequency calibration plus minus 1%

Modulation: 30% at 400 cycles

R.F. Output: 1 uV to 100mV, continuously variable through 75 ohm matched transmission line. A steady output of 1 volt is also provided through a separate socket. Using the termination pad, output impedances of 37 ohms, 10 ohms, or 10 ohms through a standard all-wave dummy aerial may be obtained.

A.F. Output: Variable 0-12 volts at 400 cycles.

R.F. Leakage: Total stray leakage less than 3 uV at 100 Mc/s.

IMMEDIATE DELIVERY

"Advance" Signal Generators are designed and manufactured as precision instruments. The same high standard of workmanship is maintained right throughout the range, from ordinary radio service models to sub-standard types for research and laboratory use. They are widely used by Australian Government Departments and Defence Services as well as industry generally.

The two models illustrated are companion instruments designed to fulfil the needs of radio service and communications engineers and, between them, provide complete radio and audio frequency signal sources for all normal requirements. They are keenly priced and are fully guaranteed.

Write for detailed specifications

A.F. GENERATOR TYPE H1

Range: 15 c/s to 50,000 c/s

Accuracy: Frequency calibration plus minus 1% or plus minus 1 c/s

Output: Sine wave—200 uV to 20 volts plus minus 1 db
Square wave—400 uV to 40 volts

Rate of rise of square wave: Less than 3 microseconds to reach 90% of peak value at 10 Kc/s

Distortion: Less than 1% at 1,000 c/s

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BX3446 (5 LINES)

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Made by ADVANCE COMPONENTS LTD., England.

NEWS AND VIEWS OF THE MONTH

Australian jets

THE first Australian-built Canberra jet bomber will make its first flight late in February.

The prototype Avon-Sabre jet fighter will take the air in late March or early April.

Also in March the first Australian-built Avon jet engine will come off the production line at Commonwealth Aircraft Corporation factory at Fisherman's Bend, Melbourne.

These three events, of major importance to the RAAF, will make 1953 a vital year for Australian air defence development.

On both the Canberra and Avon-Sabre projects there have been slight delays, due to factors beyond the control of the Australian industry.

★ ★ ★

Electric typewriters

POWER operation in the USA has extended to the secretarial and business office in the form of electric typewriters.

In these machines, everything is done by electricity except the necessarily human action of pressing the right keys in the right order.

One manufacturer of electric typewriters has instituted a series of teachers' workshops where the latest techniques in electric-typewriter instruction are explored.

At the conclusion of a six-week experimental typing class at Columbia University it was reported that "results were gratifying" because all the students using electric typewriters attained "rates that would be considered superior even after a full year of instruction."

The experiment also established the fact that it is much easier to change from the electric to the manual machine, because learning on an electric typewriter is simplified since some problems, such as carriage-return technique, are removed and the students can devote more time to actual typing.

★ ★ ★

Solar cyclotrons

THERE are solar "cyclotrons" which produce radio waves of enormous energies.

These have been postulated, and to some extent their likelihood has been demonstrated, in laboratory experiments, by United States Bureau of Standards physicists. They explain a hitherto unsolvable paradox of the new radio astronomy.

There is a constant radio wave output from the sun. The heat energy required is far greater than that which can be accounted for by the surface temperature, about 6000 centigrade. It can be explained only by the assumption that the temperature of the corona, the pearl-colored circle of light which surrounds the sun at a distance of a million miles or more from the surface must have a temperature of at least a million degrees.

Hard to accept at first, this now is generally accepted. But lately radio waves requiring far greater energies than would be produced by an extremely thin gas at such temperatures have been detected. These would require for the corona temperatures of about a billion degrees and there is no known mechanism by which these could be produced.

ENERGY DIRECTLY CONVERTED

The present thesis announced by the Bureau physicists is that there is a direct conversion of kinetic energy, the energy of motion, into electro-magnetic energy through a cyclotron effect produced on particles moving through the magnetic fields set up on the solar surface.

Constant streams of the elementary particles of matter, protons and electrons, are shot out of the sun into surrounding space at enormous speeds, comparable to the speed of light.

These elementary particles, the theory holds, are shot around in circular paths as are the particles in a cyclotron and get a new "kick" with each revolution.

Laboratory experiments carried out by bureau physicists have demonstrated that when this process goes on for a sufficient time radio waves result without going through the phase of thermal energy. Thus there is no need to assume any higher temperature for the corona than that necessary to produce the constant background "noise."

★ ★ ★

Australian gearbox

ONE of the smallest exhibits among the displays at the recent British Motor Show may be among the most important.

POPULAR SCIENCE QUIZ

Q: Why do bubbles rise to the surface of a liquid?

A: When a bubble is liberated below the surface of a liquid, forces will act on it immediately. One of these forces will be that of gravity acting on the mass of the bubble. The other force will be, according to Archimedes Principle, acting upward and equal in magnitude to the gravitational force upon the mass of water displaced by the bubble.

Because the mass of water displaced by the bubble will be greater than the mass of the bubble, there will be a resultant force acting upward. This force will impart an upward acceleration to the bubble. The initial acceleration does not depend upon the volume of the bubble.

When the bubble moves through the water, it experiences a resistance to its motion which increases with increasing velocity until a "terminal velocity" is reached. This "terminal velocity" is lower for small bubbles than for large ones, hence, if a large bubble and a small bubble are liberated at the same instant, the large one will reach the surface of the liquid first.

Q: Why do many tight-rope walkers carry a long pole?

A: The tension in the rope and the force of gravity acting downward on the mass of the walker form a system of forces which have a relatively unstable equilibrium. The condition for equilibrium, or maintenance of "balance" of the walker, is that his centre of gravity be vertically above the rope so that the weight downward and the normal reaction upward provided by the rope tension act in the same line.

If the centre of gravity be other than vertically above the rope, a couple (two equal and opposite forces) will be produced which will cause the walker to topple. The only corrective action which he may take to place his centre of gravity over the rope again is by movement of his body, arms and legs.

If he carries a long pole, the gravitational forces acting downwards on the pole now become part of the system and these forces may be adjusted more easily to maintain the centre of gravity of the man and pole vertically above the rope. In other words, he finds it much easier to "balance" himself.

Q: Why is a rifle barrel "grooved"?

A: Actually, the spiral grooving inside a barrel is called "rifling." When a bullet is fired and forced down the barrel the rifling presses grooves into the bullet and, as it is thus forced to follow the rifling, it is given a rotational motion as well as a forward velocity.

A rifle bullet is intended to meet with minimum air resistance. It is pointed and is long compared with its diameter. If it were fired without rotation, the excess air resistance under its nose would cause it to turn up after it left the barrel.

The resulting "broadside-on" flight would mean greatly increased air resistance and an altered trajectory.

When given an initial angular momentum about the long axis, both the direction of that axis and the numerical value of the angular momentum about it tend to remain fixed. However, the external air resistance causes the angular momentum to decrease and due to the upward pressure at the nose, the bullet tends to precess about a vertical axis. If the bullet has been given an anti-clockwise rotation when viewed from the breech end, this precession is to the left. The nose of the bullet will swing a little to the left, increasing the air resistance component in that direction and setting up a "drift" to the left of the trajectory.

A.C.E. RADIO

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EVENINGS & WEEKENDS: "KALUA," COLLAROY ST., COLLAROY — XW5956

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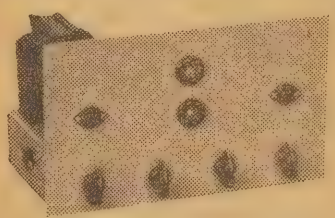
Type G4 DECK

OPERATES FROM YOUR OWN GRAMO MOTOR WITHOUT ANY ALTERATION OR FITTING TWIN-TRACK. 1 HOUR ON SINGLE SPOOL AT 7½" PER SECOND. 2-SPEED IF USED ON MULTI-SPEED TURNTABLE. FITTED WITH HIGH FIDELITY RECORD/PLAYBACK HEAD AND ELECTRONIC ERASE HEAD. COMPLETE WITH 2 SPOOLS AND ROLL OF TAPE. COMPLETE AND TESTED.

£24/19/6

Medium impedance Twin Track and Erase Heads available from £3/17/6.



No. 1 TAPE RECORDER

R & H NOVEMBER

COMPLETE KIT OF PARTS INCLUDING POWER EQUIPMENT & VALVES. LESS O/P TRANSFORMER

£19/5/-

WIRED AND TESTED — £23/17/6

No extra charge if required for electronic erase

No. 1 ADAPTOR

R. & H. JANUARY

Complete Kit **£9/6/6**

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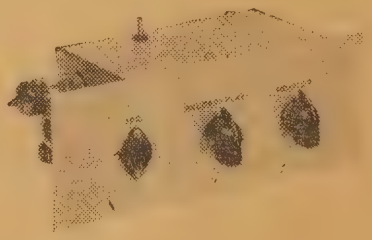

No extra charge if required for electronic eras

EXCEL KITSETS

Kar Set £24/17/6 Wired and tested £30/-/-
Radiogram 6DW £28/15/- Wired & tested £32/10/-
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Pentagrid 4 £13/17/6 Wired and tested £16/7/6
Pentagrid 5DW £22/17/6 Wired & tested £25/17/6
Little General '52 Plastic or wooden cabinet £16/17/6
Minivox Kit £14/7/6

It is an Australian invention—an automatic gearbox designed for use in popular-priced British cars, and it is expected within a few years to do away entirely with mechanical forms of gear-changing.

Inventor is Mr. Howard F. Hobbs, of Melbourne, a fruit-farmer's son. His automatic gearbox was made in Leamington Spa and is at present the subject of negotiation with one of Britain's "Big Five" motor car manufacturers, and although Hobbs will not reveal which this is, it is perhaps significant that the testing car at the Motor Show is a 1953 model Morris Oxford.

With the new gearbox the car has no gear lever and only two pedals—brake and accelerator. Hobbs' claim for his invention are that normal petrol consumption is slightly improved, the automatic gearbox is just as practical for an 8 hp car as for a large car, and that mass-produced cars can be fitted with the gearbox at an extra cost of from £10 to £20. The gearbox is worked by hydraulic control within the box itself and all that the driver needs to do is to move a small lever on the steering wheel into "drive" for forward motion and "reverse." The rest of the work is done by the accelerator.

★ ★ ★

Atom-powered sub.

THE Westinghouse Electric Corporation of USA announced the successful trials of an electric motor to be used in the first atomic submarine engine. The tests extended throughout 18 months without any breakdown.

The motor is enclosed in a protective container to guard against radioactive leakage which would be dangerous to the crew.

A second motor is undergoing shock tests to determine how it will withstand actual battle conditions.

★ ★ ★

Radio interference

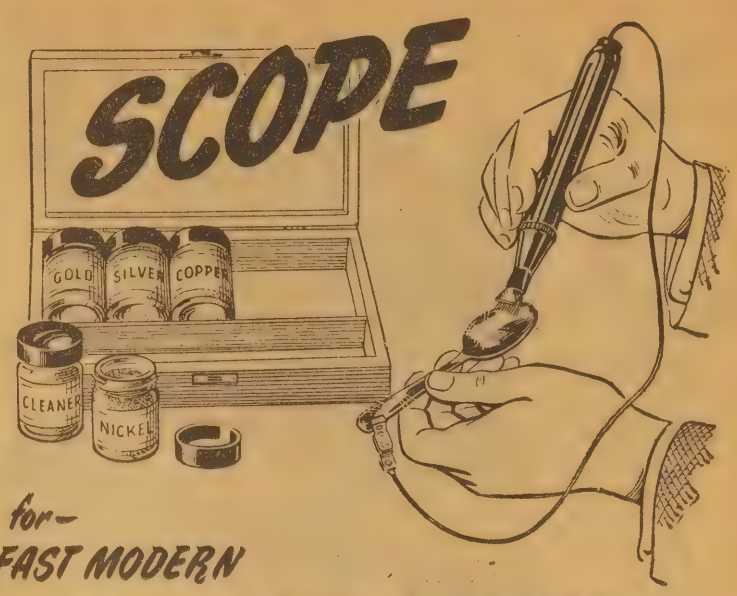
THOSE of us who live in the suburbs take our radio entertainment very much for granted. Sets are tuned from one station to the next with never a thought that the desired program may not be immediately available.

It doesn't take more than a couple of weeks holiday in the country to shatter this easy-going attitude, particularly if it happens to be in a poorly served area.

Our most recent venture landed us in a spot where even the "local" station was virtually blotted out by atmospherics for an average of one day in three. What was more unfortunate, on the remaining two days, the signals had to compete with local interference and we didn't need to be detectives to trace it to three apparent sources (1) an electric water pump next door; (2) an old type frig. motor; and (3) an electric shaver nearby.

Presumably these devices have been accepted locally as a perfectly normal and indispensable hazard to radio reception.

Sufficient to say that it took less than a week to break our confirmed listening habits and pick up a book instead for the evening's entertainment. Which is hardly what the program sponsors intend.



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FAST MODERN

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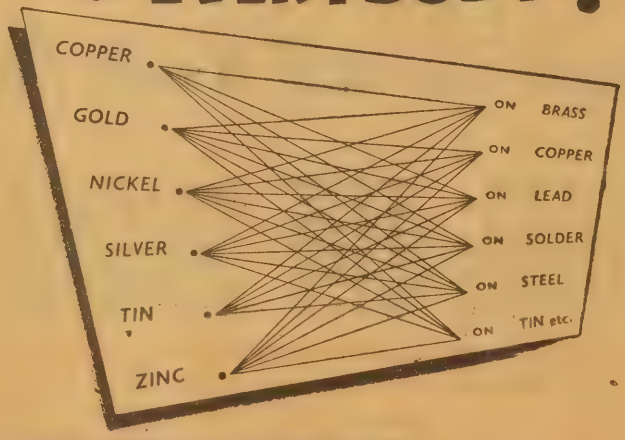

ANOTHER REVOLUTIONARY
SCOPE Product

Bringing the art of Electroplating within easy reach of the handyman

The Plating Brush, powered by two torch cells (type 915) contained in the handle, is dipped into the paste electrolyte and applied to the cleaned and polished object in a slow circular motion. Metal is deposited at once at the rate of approximately 1/10,000" per minute of actual contact.

Suitable for instrument parts, models, car reflectors, cutlery, jewellery, repair work, metal dishes, etc.

Patent applied for.

Standard set in solid wooden case (Nickel, Copper, Tin).
48/6 (Vic.)
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Additional jars: Gold 15/9
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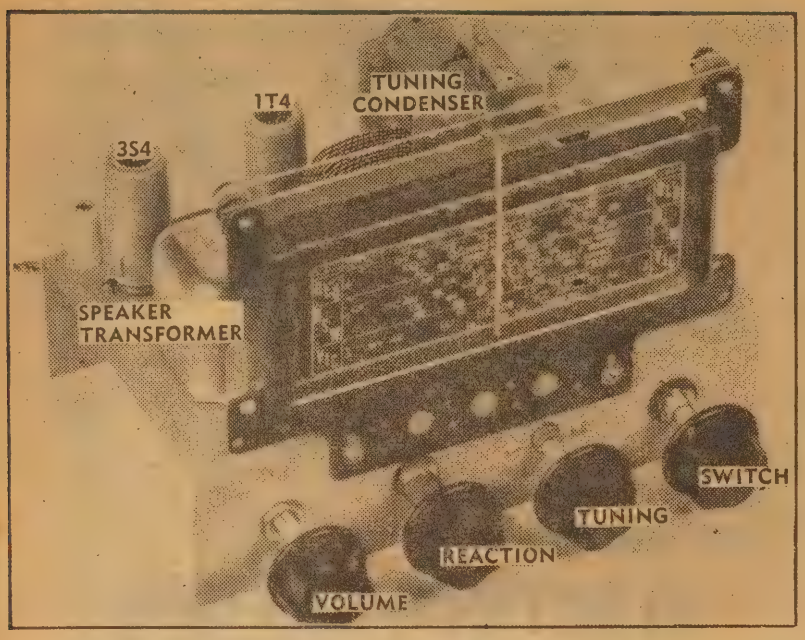


This picture shows the switch control at the right and the extra valve next to the tuning gang.

Teach Yourself Radio (6)

ADDING THE SHORT-WAVE COILS

Our regenerative receiver is completed this month by the addition of an extra valve and a second coil, together with a switch which allows it to be changed quickly from broadcast to shortwave. The short-wave coil will enable you to receive many hundreds of the powerful overseas broadcasting stations while the extra valve gives a reserve of gain for the weaker signals.

by Maurice Findlay

AS we have already mentioned, there will be times when the gain of the set described last month will not be sufficient to make use of the available power output. No matter how much power the output valve is capable of delivering, it is of no avail unless the weak signal from the aerial is amplified to the required degree before being passed on to the output valve grid.

On some occasions you may be restricted to a small aerial which means that the amount of energy collected by the aerial is small or possibly you will wish to listen to distant stations, where again the signal received by the aerial is weak.

SHORT-WAVE BANDS

Of major interest to us this month is the possibility of listening to short-wave stations. Here in Australia we will be interested mainly in listening to short-wave stations from far distant countries. Programs from England, America, India, Japan and hundreds of other countries are waiting for those who have the equipment and the small amount of time and patience necessary to look for them.

Although the major overseas broadcasting stations use tremendous power, the level of the signals reaching our shores will be comparatively low because of the vast distances to be covered. Here again is a case for a reserve of amplification in a receiver.

In our receiver the extra amplification can be obtained by adding an extra valve between the detector valve and the power amplifier valve. Such a valve is not required to deliver a great amount of audio power: it only has to supply enough power to drive the grid of the power output valve. Therefore its design can be such as to give a high degree of amplification, with power output a secondary consideration.

Type 1T4 as used for the detector in last month's receiver is excellent as a voltage amplifier. It is capable of giving a high degree of amplification and at the same time requires only small filament and high tension power.

When we used the 1T4 as a detector it was necessary to use a relatively low value of plate load resistor and a correspondingly lower screen dropping resistor so that the regenerative circuit could be made to work efficiently. The valve still does give a high degree of audio amplification, but not the maximum obtainable.

PLATE LOADS

When a 1.0 meg plate load resistor is used with the 1T4, the amplification is very much greater than with the 0.1 meg load. In order for the valve to work to best advantage it is also necessary to increase the screen dropping resistor to 3.0 megohms.

A fortunate feature of the 1T4 under these conditions is that it does not require any negative grid bias and therefore the grid return resistor can be returned to earth.

The overall gain of the set is equal to the gain of the individual valves multiplied together. With three valves the maximum gain may be much greater than required in many cases. Therefore some means must be found to adjust it to the amount required.

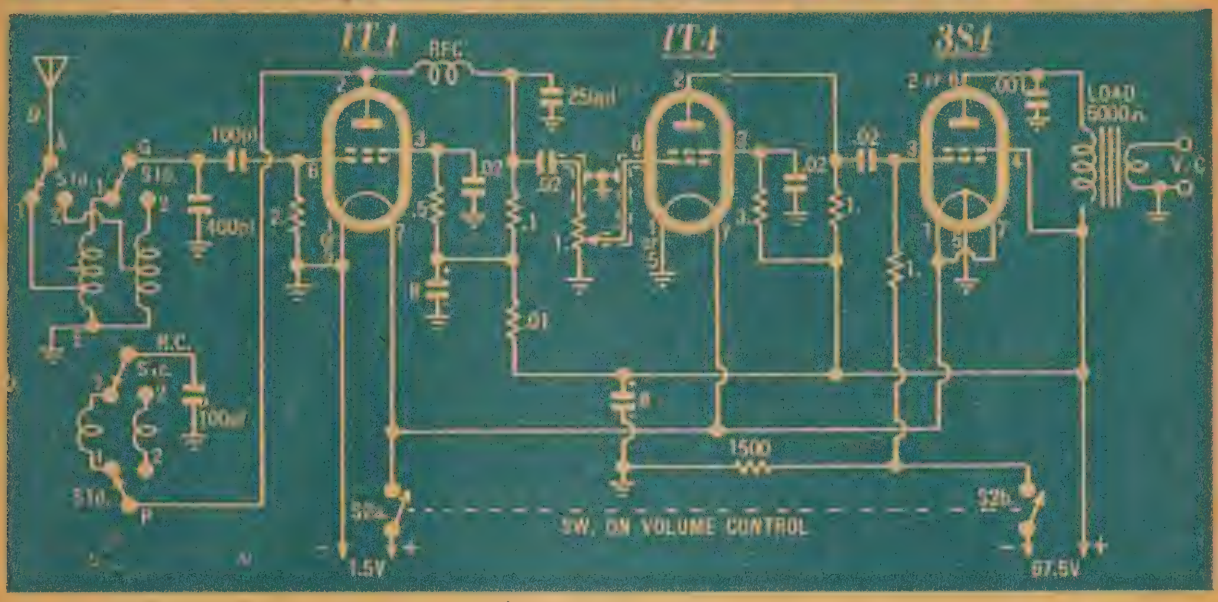
Some control over gain can be had by adjusting the regeneration control. If the regeneration is adjusted a little below the peak setting the volume will decrease. However, this has the disadvantage that the selectivity is reduced and a station on a frequency adjacent to the desired station may cause interference.

VOLUME CONTROL

This was not so noticeable in the smaller sets because the limited overall gain made it necessary to operate the regeneration near the peak setting to get sufficient volume in any case.

To get over the difficulty we insert a volume control between the 1T4 detector and the 1T4 amplifier stages. The volume control is actually a resistor with a variable tap.

CIRCUIT DIAGRAM OF THE SHORT-WAVE VERSION



Our circuit is growing up! The short-wave coil switching is quite simple to wire up.

Audio frequency voltages from the detector appear across this resistor and by adjusting the position of the tap, we can use as much or as little of the output of the detector as we please.

When the tap is adjusted so that it coincides with the top of the resistor, the full gain of the set is available. If the tap is adjusted so that half the resistance is above it and half the resistance below, only half of the voltage delivered by the detector will appear at the grid of the 1T4 voltage amplifier. Again, if the tap is adjusted so that it coincides with the earthed end of the resistor, none of the signal from the detector will appear at the grid of the voltage amplifier and the overall gain of the set will be zero.

Any value intermediate between the values mentioned can be obtained by suitable adjustment of the tap. Incidentally, a tapped resistance is known as a potentiometer and for radio use is generally made in a form such that it can be controlled by means of a knob.

EXTRA AUDIO

Of course, you are already familiar with the potentiometer we have suggested for use with this set. It has a pair of switch contacts at the rear, allowing the one control knob to perform two functions. Also, the resistance element is especially tapered to give a smooth control of volume right from the minimum to the maximum setting.

By now you will probably be on the point of suggesting that a further audio stage be added to the set to increase the gain still further in order that extremely weak stations can be heard.

There are several reasons why there would be little point in doing this. With a very high gain amplifier there is a danger that a small amount of the energy from the output circuit will find it way back into the input circuit and cause unwanted oscillation.

There are all sorts of precautions you can take to avoid this, but the amplifier tends to become a clumsy and complicated affair.

When the gain becomes very high, feedback takes place even through the high tension power supply. This is especially likely to happen when the B battery is almost exhausted.

To avoid the possibility of trouble of this sort, we have included what is known as a decoupling network to isolate the 1T4 detector valve from the rest of the amplifier. This network consists of a .01 megohm resistor and an 8 mfd condenser. Their total effect is to provide a separate return point for the detector stage and prevent trouble with oscillation due to coupling between the detector and the other two stages.

Noise generated by the valve and its input circuits also limits the maximum gain that it is practical to attain. There is no need at the moment to go into a detailed explanation of what causes noise. Sufficient to say that it is connected with the fact that electric currents are not absolutely smooth movements of electrons, but rather that the electrons tend to move in a random fashion under many circumstances.

NOISE LEVEL

If the amplification is increased above a certain amount, this noise level may actually be louder than the signal you wish to hear. When this is the cause, of course, some of the

PARTS LIST

- 1 chassis 8in x 5in x 2in.
- 1 USL37G dial.
- 1 400 pf variable condenser.
- 1 100 pf variable condenser.
- 1 reinartz coil.
- 1 3S4 valve.
- 1 1T4 valve.
- 1 1.0 meg. potentiometer. (with switch.)
- 2 7-pin miniature valve sockets.
- 4 spring-loaded terminals.
- 3 tag strips.
- 3 knobs.
- 1 ¼in extension shaft.
- 1 rubber grommet.
- 1 RF choke. (section wound)
- 1 speaker transformer (5000 ohms to V/C)
- 1 1.5 volt battery.
- 1 67.5 volt battery.
- 1 8 mfd electrolytic condenser.
- 2 .02 mfd paper condensers.
- 1 .001 mfd fixed condenser.
- 1 250 pf mica condenser.
- 1 100 pf mica condenser.
- 1 2.0 meg ½ watt resistor.
- 1 1.0 meg ½ watt resistor.
- 1 .05 meg ½ watt resistor.
- 1 .01 meg ½ watt resistor.
- 1 1500 ohm ½ watt resistor.

You will need the following extra parts to complete the three-valve dual-wave receiver.

- 1 1T4 valve.
- 1 6 x 2 switch.
- 1 1¾in length ¾in diam. coil former.
- 1 8 mfd electrolytic condenser.
- 2 .02 mfd paper condensers.
- 1 3.0 meg resistor.
- 1 1.0 meg resistor.
- 1 0.01 meg resistor.
- 1 knob.

Approx. 9in shielded wire, hook-up wire, tinned copper wire, solder lugs, solder, flux, nuts and bolts, scrap sheet metal, &c.

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O9—Standard Osc. Coil for ECH35, 33, 34, X61M, 6AN7, 6AE8	12/11	11/7
IF3/4—Standard Gen. Purp. 455 Kc IF's	17/5	15/6

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RC2—Mini. Car Radio R.F. Coil	14/6
RC3—Mini. R.F. W./Reaction	14/6
RC5—Standard High Gain R.F. Coil	12/11
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RC8—Standard Reinartz Coil	12/11
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O2—Mini. Osc. Coil for IR5, 6J8, etc.	12/11
O4—Mini. Coil for ECH33, 34, 35, X61M, 6AN7, 6AE8	12/11
O5—Mini. Osc. Coil for 6BE6, 6SA7	12/11
OME—Magnetic Tape Recorder bias coil	18/4
ICI—Ignition Hash Coil for Car Radios	1/7
RC9—Untuned R.F. Coil or 16M.H. R.F. choke	4/-
K1—Knobs, flush; walnut, black, ivory	1/3
IF12/13—Miniature 1600 Kc IF's	19/4
IF8/9—Standard High Gain 455 Kc IF's	19/4
IF10/11—Standard High Gain Batt. Type IF's 455 Kc's	17/5
IF14/15—Standard Gen. Purp. 1900 Kc IF's	19/4
IF1/2—Miniature 455 Kc IF's	19/4
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DW5—Midget single stage unit B/C and 16-50M, suit ECH33, 34, 35, X61M, 6AN7, 6AE8 converters	72/6
DW6—Midget single stage unit B/C and 16-50M suit IR5 converter	72/6
DW7—Midget single stage unit B/C and 16-50M suit 6BE6, 6SA7	72/6
DWR4—Midget R.F. stage unit as for DW4	135/4
DWR5—Midget R.F. stage unit as for DW4 also B/C and 13-42M	135/4
DWR6—Midget R.F. stage unit as for DW6	135/4
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RFC3—2.5 mH choke 100 mas iron cored	4/-
S.W.—Standard Short Wave Coils, all types	6/10
USW—Unwound formers comp. with core and mounting grooved 16 T.P.I.	4/10
C.D.—Poly. coil dope and sealer, 3/5 jar	
WFC1—Whistle Filter Choke	8/9

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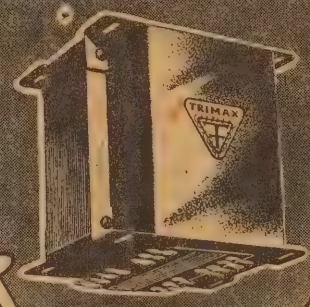

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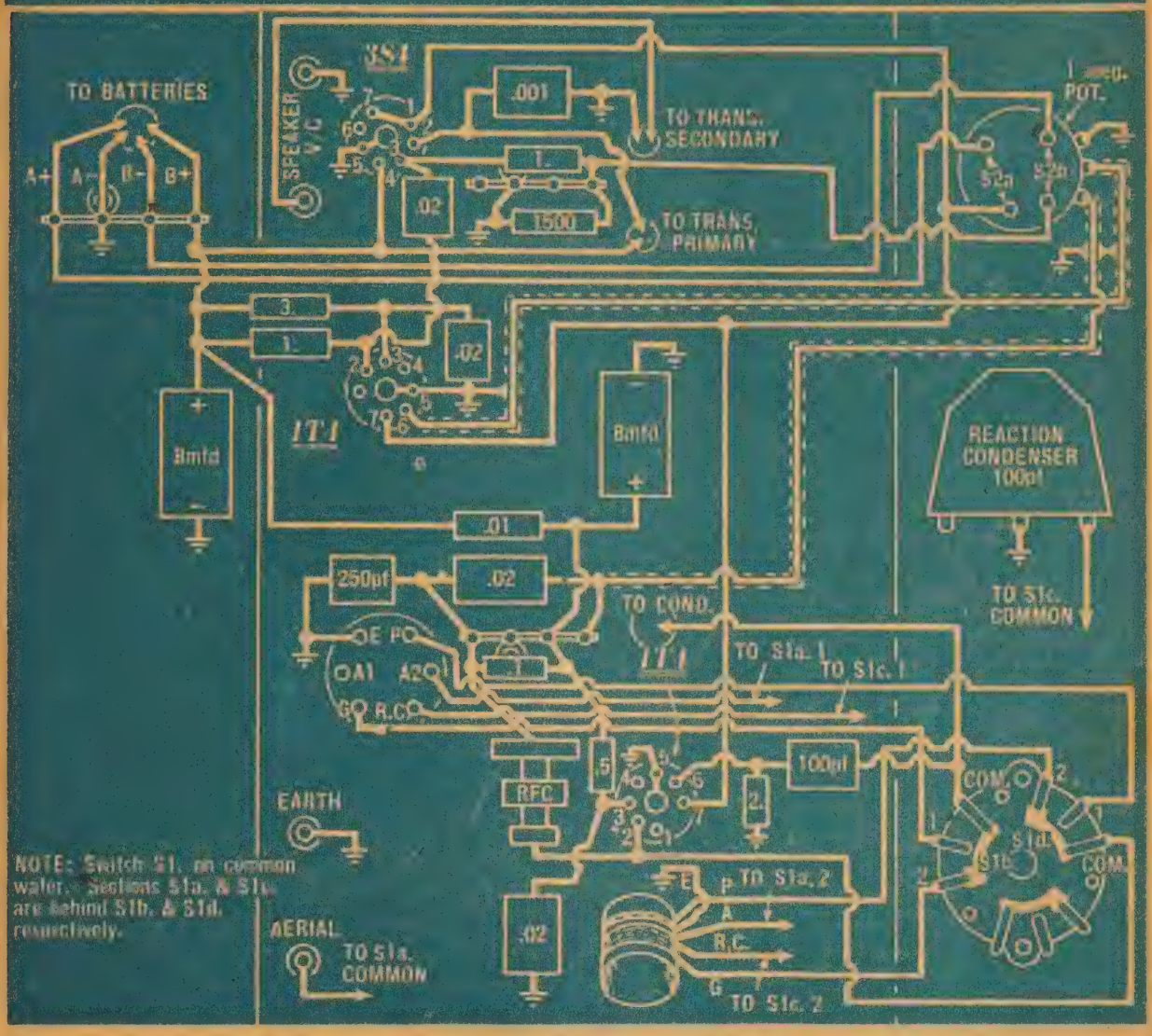
WIRING DIAGRAM OF THE SHORT-WAVE VERSION



This wiring diagram should greatly help you in making up the set or altering last month's version.

amplification is of no value, because it cannot profitably be used.

With our new set there is some noise when the regeneration is adjusted to the optimum and the audio gain turned full on. However, it is low enough for the full gain to be useful.

Most of the limitations we have been discussing can be minimised by employing quite different ideas. For example, special amplifiers can be employed to amplify the signal before it appears at the detector stage. The most satisfactory is to employ what is known as the superheterodyne principle and after completing the present receiver, many readers will be keen to try their hands at building a superhet. But more of that later.

With the extra amplification available we are in a position to obtain useful signals from overseas short-wave stations. To receive these stations it is necessary to alter the tuning range of the set so that it covers the frequencies on which they operate.

To vary the frequency to which the set is tuned within the broadcast band you simply vary the setting of the tuning condenser. The larger the range of the tuning condenser the greater the range of frequencies which it is possible to tune.

However, there is a limit to the range of frequencies which can be tuned. When the capacity of the condenser becomes very large compared with the inductance of the coil, the tuned circuit is not very efficient. The difficulty can be overcome by dividing the tuning range into two or more sections.

TUNING CONDENSER

The tuning condenser specified for this set has a capacity range from about 10 pf to about 400 pf which under the conditions in this set gives a tuning range with a ratio of more than three to one of the highest to the lowest frequency. Had the tuning range been increased the efficiency at the low frequency end of each range would have been poor.

Instead of using a large condenser to cover the required range therefore, we use the condenser which will allow a good efficiency and use different coils.

As you will remember from the first article in the series, the range of frequencies used for radio communication is very wide. To cover them all would require a very large number of coils. Fortunately, you are not likely to want to cover all the frequencies.

The very high frequencies are devoted to many special services that are not likely to interest you for the purpose of general listening. In any case a simple receiver such as this does not work particularly effectively at frequencies above about 15 Mc's.

This happens to be a convenient frequency for us to set as the high frequency limit of the tuning range because as well as two of the more important amateur bands, the set can then be made to cover the most interesting of the short-wave bands used for the broadcasting of general entertainment and news.

The total tuning range of the set

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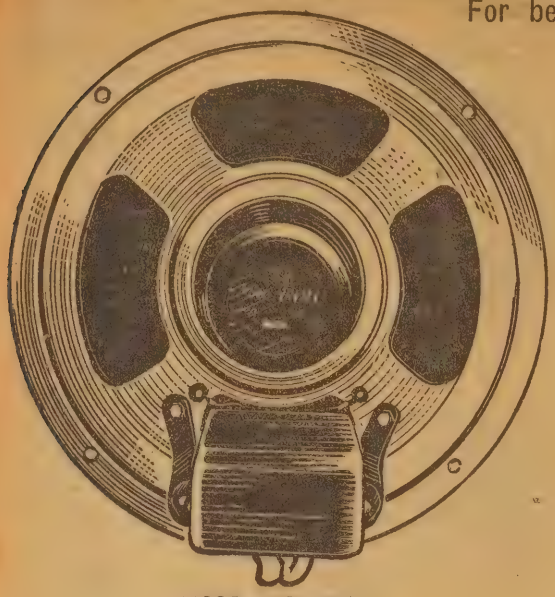

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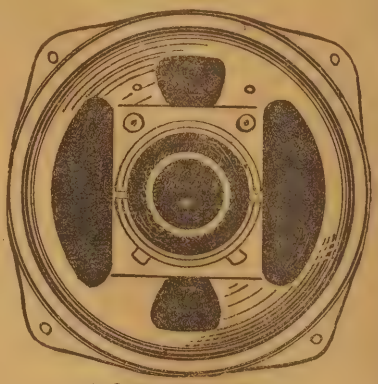
8P1—	8"	**64/9**
10P2—	10"	**69/3**
10P1—	10"	**74/11**
12P2—	12"	**74/4**



MODEL 525—47/3

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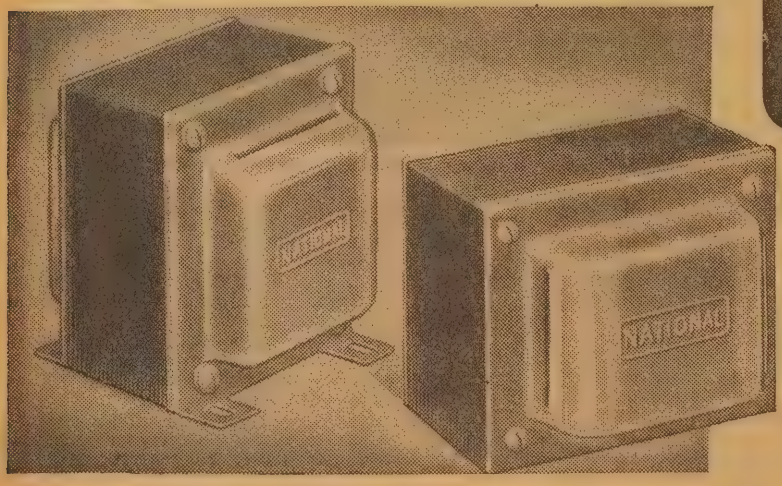

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is from 15 Mc down to about 4 Mc. Most of the interesting short-wave stations are in the vicinity of 15 Mc, 11 Mc, and 9 Mc, while the amateur bands are at 14 Mc and 7.0 Mc.

Art Cushen's short-wave notes and Bill Moore's notes on the amateur bands are gold mines of information on the latest in their respective fields so that we will not attempt to go over the same ground here.

Getting back to the construetional angle, there are two popular ways of changing the coil in order to alter the tuning range. Both have advantages.

PLUG-IN COILS

In one case a socket is installed on the chassis and to the various lugs of the socket are brought all the leads that need to connect with the coils. The coils are then wound on a former fitted with a plug base so that they can be installed simply by plugging them into the receiver. You can wind as many coils as you like and try them out without disturbing the wiring of the set, which offers unlimited scope for experimenting with different ranges and different adjustments of the windings.

If you are keen on the idea, by all means go ahead along these lines. A socket, say a six-pin type, may be installed in the space at present occupied by the broadcast coil and all the necessary wires terminated on appropriate lugs. As well as a short-wave coil or coils you can wind a broadcast coil connecting the wires to the pins of the coils to correspond with the socket. The commercial broadcast coil could also be fitted with a plug if desired.

If you are interested, a page of general information on coils suitable for small receivers is available through the 2/- query service.

There is a group of enthusiasts who prefer not to have a number of coils lying around and who like to have the advantage of being able to select the tuning range by means of a switch. The coils are then permanently attached to the set and their connecting wires soldered to the appropriate terminals of the switch. According to its position the switch selects the required coil.

COIL SWITCHING

In this particular set a switch capable of switching four wires each to one of two other wires is required. The nearest standard switch capable of meeting the requirements has some contacts to spare but this does not matter.

The short-wave coil suggested for the switching arrangement is wound on a length of ¾in bakelised paper tubing. Ordinary cardboard will do provided it is reasonably strong. The ideal is polystyrene tubing but it may not always be easy to get. The diagram published here will give you all the information you need.

We have worked out quite a neat method of attaching the coil to the chassis and you also may care to use it. You will require a piece of sheet metal about ¼in by 1in. Its thickness isn't important but something about 1-16in thick would be suitable. In the centre of this piece of metal drill a 1-8in hole. Also drill a 1-8in hole in the appropriate chassis position.

If now a pair of slots, one on either side of the former, are cut ¼in by 1-16in, the piece of metal can be passed through them. A 1-8in bolt can then be passed through the chassis and the hole in the metal and used to secure the coil to the chassis.

You will find that the specifications we have given for the coil are optimum for most applications. However, with sets of this type there is always room for experiment due to the dependency of the coil specifications on the aerial and earth system used.

If you find that it is hard to make the set oscillate over the entire width of the band for example you could try a slightly greater number of turns on the feedback coil or tapping the aerial connection further down the coil. For very short aerials you may find it advantageous to move the aerial tap further up the coil. In general, the comments made in connection with the adjustment of the broadcast coil apply.

The coupling between the two windings has to be fairly great in order that the regeneration be reliable over the whole band and for this reason we have suggested that a few turns of the feedback coil be interwound with the tuned winding.

Do not try to extend this too much because the setting of the reaction condenser will have too great an effect on the setting on the tuning condenser. A certain amount of interaction will be inevitable in a simple receiver such as this but everything that can be done to avoid it should be done.

It is sometimes particularly difficult to make the set actually oscillate at the extreme low frequency end of the band. In most cases it will not be too difficult to have it in the verge of oscillation, in which case the performance will be satisfactory.

"SQUEGGING"

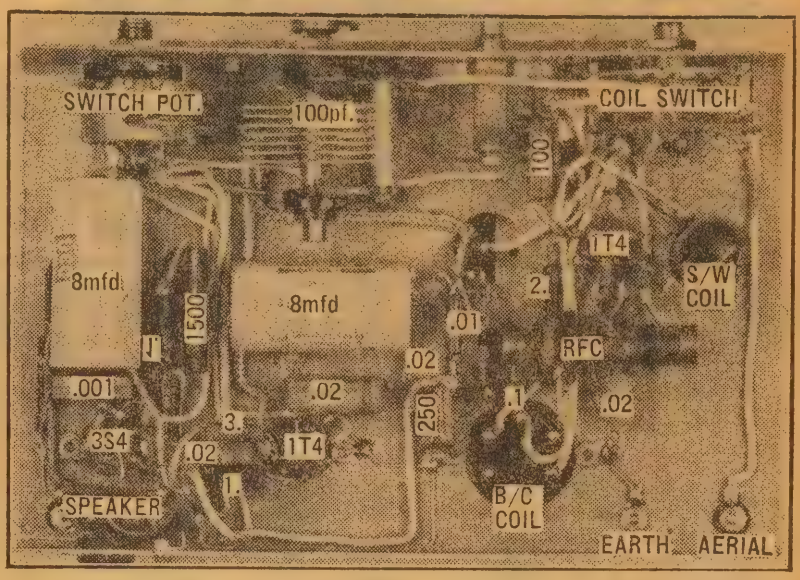
In some cases the set will have a tendency to "squeg" or burst into an audible low frequency oscillation simultaneously with the high frequency oscillation. This can often be cured by using a 1.0 meg. grid return resistor for the detector instead of the 2.0 meg. resistor shown.

We anticipate that the set will work perfectly as soon as you switch it on with the coil wound to the specifications given but we mention the above just in case!

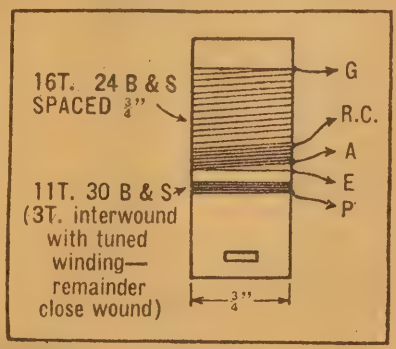
Ordinarily, the set should be adjusted just below the point of oscillation for best performance. When the set is allowed to oscillate, the signal from the station and the signal generated by the detector "beat" together to make an audible note.

This phenomenon can be used to receive unmodulated Morse code transmitters, many hundreds of which will be able to be tuned by the short-wave coil. Set the detector oscillating very weakly and tune around until you hear some of them. Each time the operator presses the key you will hear the heterodyne note. The note can be varied by varying the setting of the tuning condenser. This is a handy feature since it is possible to adjust for the note which

UNDERCHASIS VIEW OF THE SET



There are more parts now under the chassis. The short-wave section is grouped at the top right.



The above diagram shows how to wind the short-wave coil to cover 4 to 15mc. The former is 1¾in long.

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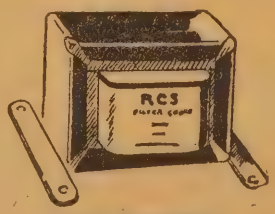
Audio transformer.

Midget Magnasonic Coil.

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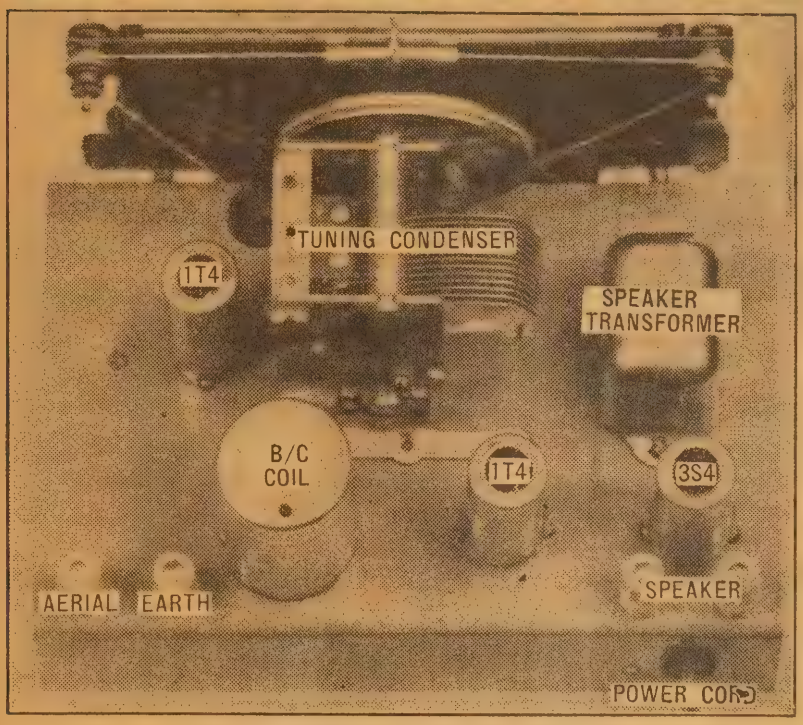
TOP VIEW OF THE S/W RECEIVER



This photograph shows the layout from above.

best stands out from the prevailing noise level or interference from other stations.

For those who are studying for their amateur operator's certificates, the receiver offers an excellent opportunity of gaining practice in receiving Morse code under actual operating conditions. Amateurs use Morse code on both the 7 and 14 Mc bands and you will often find stations sending quite slowly.

Many of the commercial stations you will hear send code groups consisting of letters and figures. These are very good for receiving practice because you cannot possibly guess what the next character is going to be.

This little receiver is an excellent one of its type and we know that hundreds of experimenters will have a lot of fun and learn a great deal about radio in building and operating it.

SIMPLE SET

We make no apology for the fact that it is not the ultimate in radio receivers. To recommend that a beginner build a full scale superhet would be unwise. The parts are expensive and without the background of some experience the chances of assembling them correctly are not good.

However with solid background of wiring technique and elementary theory of valves you are in a position to tackle something more ambitious with confidence.

In the concluding article in the series next month, we intend to talk about superhets and more advanced receivers generally. The article will be an excellent guide to those who wish to proceed farther with the hobby and particularly will deal with means of using parts from the present receiver in a larger job.

Others will be interested in making AC operated sets. For them we can recommend the "Learn While You Build It" series of articles which started in the March, 1951, issue of Radio and Hobbies.

The first mains operated set in the series appeared in the June issue and this was enlarged issue by issue until December of the same year, when the reader was able to build a full scale 4-valve mains operated superhet.

We regret that none of the issues concerned are available from our back dates department but possibly you will be able to borrow them.

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FROM THE SERVICEMAN WHO TELLS

This month I have a rather interesting story about a non-technical owner's attempt to repair his set—and the horrible mess he made. There is also another case of trouble with loose valve bases and a rather ingenious repair.

THE following story — related to me by a colleague — really approaches the "tall tale" variety but, for your greater enjoyment, let me hasten to assure you that it is perfectly true. As a matter of fact, I am not all all keen in relating improbable stories unless I know for certain that they are true. This generally means that they are either incidents which have happened to me personally or to close acquaintances and friends whose word I cannot doubt.

In this particular case my colleague was able to lend weight to his story by producing actual physical evidence for all to see, and I am hoping the editor can find room to reproduce a photograph of it.

REPAIR STORIES

Some of my regular readers may remember a couple of stories which I have related in the past about non-technical attempts to repair receivers, the sounds issuing from which did not please the owners. One of these concerned a loud speaker which had, apparently, developed a rattle or buzz due to misalignment and which the owner decided to repair himself.

His investigation showed him that the buzz was coming from the speaker cone and, more particularly, from the region of the voice coil. The fact that the cone was free to move seemed all wrong and he was quite convinced that it had broken away from its support at this point.

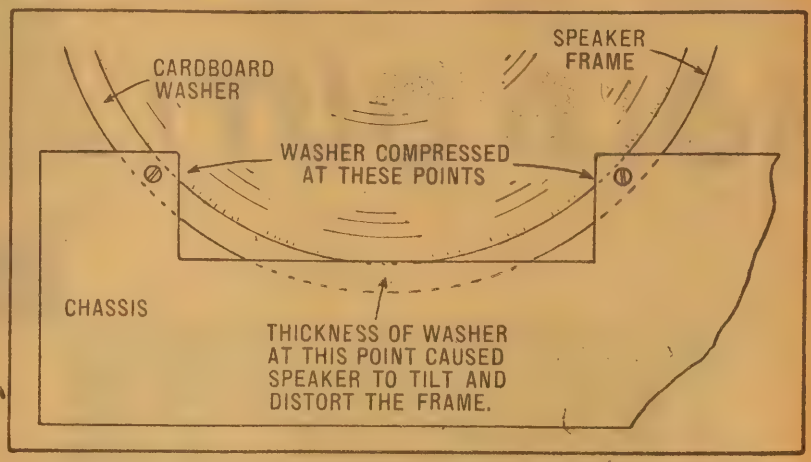
On this basis his repairs consisted of applying copious quantities of liquid glue to the voice coil and allowing it to run well into the annular gap. Strangely enough, it worked—for a while—the viscosity of the glue being sufficient to effectively damp out the buzz, and the owner was able to enjoy an evening's distortion-free entertainment.

Next morning, however, it was quite a different story, for the glue had had time to harden and the set was completely dead. The owner eventually called me in and I was led a merry dance trying to discover why a speaker which was completely intact electrically stubbornly refused to utter a sound!

INGENIOUS CURE

On another occasion I encountered a set which had developed a terrific hum due to the failure of both electrolytics. In this case the owner had cured the hum by the ingenious method of stuffing thick wads of newspaper between the speaker cone and frame, thus effectively restricting the cone movement at all but the highest frequencies. Once again the "cure" worked —after a fashion—although the reproduction was woefully thin and weak.

I have made brief reference to these cases because they, along with the one I am about to relate, indicate a very definite line of reasoning of a goodly percentage of the non-technical public, namely, that any objectionable noises which a set gives forth must be caused by the speaker, since that is obviously where the sound comes from.

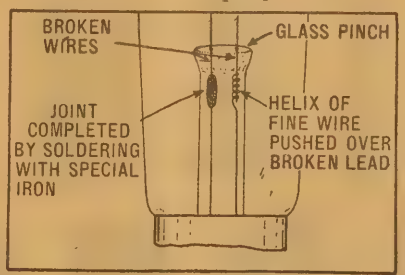

SPEAKER FRAME
CARDBOARD WASHER
WASHER COMPRESSED AT THESE POINTS
CHASSIS
THICKNESS OF WASHER AT THIS POINT CAUSED SPEAKER TO TILT AND DISTORT THE FRAME.

Showing how a temporary mounting for a loudspeaker caused the speaker frame to be distorted with consequent rattles in reproduction. Main cause of the trouble was the compression of the cardboard washer at the two mounting points.

However, as far as "cures" are concerned there is plenty of scope for variety and, while I regarded the above cases as ingenious, what is to follow surely eclipses them both.

When my colleague was called to service the set he was led to understand that it was a simple case of complete failure and assumed, therefore, that it would be a fairly straightforward job. Nevertheless, he made some routine enquiries of the owner as he was about to remove the set (a mantel model) from its cabinet.

In answer to a query as to the exact circumstances in which it had failed, the owner explained that the set had developed a rattling sound and that he had removed it from the cabinet in an effort to locate this. He claimed to have traced the trouble to the "speaker fabric" which he had removed, adding, "—but after that the set wouldn't go any more."



Details of a rather intricate repair to a damaged barretter. For this job a special bit had to be fitted to the soldering iron because of the restricted space and the new leads had to be carefully shaped before fitting.

By this time the serviceman was sliding the set out of the cabinet and was horrified to see that the speaker was completely minus its cone.

"Is that what you removed?" he asked.

'Yes," replied the owner. "You see, when I took the set out of the cabinet I could see that that was the part that was rattling, so I cut it out."

He had, too. Around the suspension spider in the centre could be clearly seen a number of straight cuts, obviously made with a razor blade. Around the outside edge the job was not quite neat, possibly due to the presence of some small tears before he started, but more likely because he felt that, having exercised due care in freeing it from the central mechanism, there was no longer any need to worry. What he thought the cone was put there for in the first place, I, or my colleague, simply cannot imagine.

CONDENSER CAPERS!

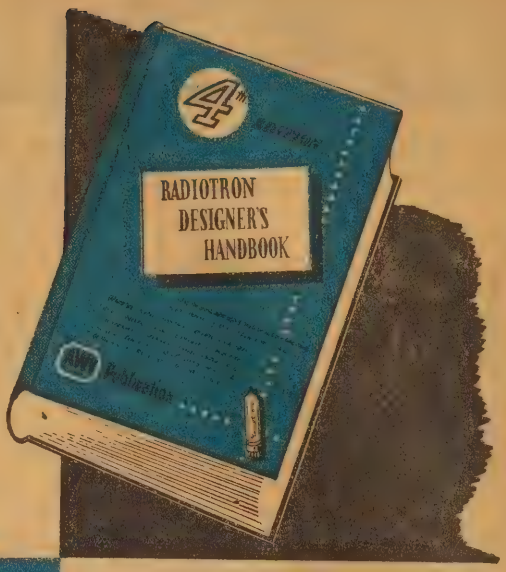
However, worse was to come. My colleague, idly turning the dial while trying to explain the seriousness of the damage to the owner, noticed that the movement was very stiff and that this, in turn, was due to the moving plates of the gang condenser rubbing against the fixed ones. When this was pointed out to the owner he commented: "Oh! Shouldn't they be touching? I thought they had to touch. When the set wouldn't go after I took the speaker thing out I bent them all over to make them touch."

No comment. Words fail me.

I rather gather they also failed my colleague and he contented himself with advising the owner as to

FIRST PRINTING

SOLD OUT!



AWV

Acclaimed by the press and public alike the entire first printing of this popular handbook has been completely sold out.

In response to insistent demands, a further printing has been arranged and new stocks are expected to be available early in May.

RADIOTRON DESIGNER'S HANDBOOK

AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

the approximate cost of repairs, as far as they could be assessed, and bringing the set back to his shop. He had advised the owner that a new speaker might be necessary and this proved a wise precaution because the makers, to whom it was sent for repairs, returned it with the advice that it was too old to be repaired.

TOO COMPACT

They suggested a modern permag type with the necessary filter choke and dropping resistor added but, unfortunately, this proved impractical because of the compact nature of the set, there being no odd corners in which the additional components could be fitted. This meant that, as well as a new speaker being needed instead of a relatively inexpensive repair, it also had to be an electrodynamic type.

This was only available in another brand and a metal bracket had to be made to accommodate the altered mounting holes, while a chassis mounting electrolytic had to be removed to avoid fouling a slightly larger field housing.

The gang, in spite of the butchery, did not appear to be permanently damaged and my colleague decided that it would be economical to try repairing it. This proved to be quite satisfactory, although a trifle tedious, and after much prodding and bending it was eventually restored to working order.

REALLY A HUM

At this point the set was switched on for a trial, and proved what we had both suspected from the first, namely, that the "rattle" which had caused all the bother was really a very severe hum due to both electrolytics having failed. Thus it is more than likely that there was nothing whatever wrong with the original speaker which the owner so foolishly destroyed.

Eventually, when all the costs of labor and material were added up, the owner was presented with a fairly substantial account; certainly many times greater than if he had simply called in a serviceman in the first place to replace two electrolytics.

Another rather interesting fault which came to my notice recently also concerned a speaker. A home builder brought a small mantel set, which he had just constructed, to me for alignment and mentioned that he was also having some trouble with the speaker which developed a buzz after it had been running for about half an hour.

The speaker was a five-inch electro-dynamic type and, although not new, had recently had a new cone fitted by the makers and should have been as good as new. The development of the buzz only after a definite running period suggested, of course, that there was a certain amount of misalignment of the voice coil in the gap and that this was aggravated by the heat generated in the field.

ALIGNMENT

The alignment proved to be quite straight forward and by the time this was finished the speaker was showing unmistakable signs of distortion. Exerting light pressure on the cone at various points on the circumference showed that the buzz became much worse when the cone was forced in one direction and tended to improve when it was forced the other way.

A simple way to cure hum! The result of a non-technical owner's attempt to repair his own set. He reasoned that, since it was the cone which was humming, it must be the cone that was at fault so, with a few strokes of a razor blade he removed it completely. It stopped the hum all right—and the signals. The speaker was not able to be repaired and had to be replaced at considerable cost.

The improvement occurred when pressure was applied to the bottom of the cone in the general area where the speaker was fastened to the front of chassis with two bolts through mounting holes in the outer edge of the frame. The field of the speaker was supposed to be resting on the top of the chassis but investigation showed that there was a slight forward tilt to the speaker so that there was a small clearance between the two.

This gave the first clue to the trouble because it appeared that the whole weight of the speaker was being supported at only two points on the frame. The owner explained that the mounting was really only a temporary one as he had not yet decided exactly how the set was to be fitted to a cabinet.

As soon as one of the mounting bolts was removed and the speaker allowed to rest on the chassis the buzz vanished, but re-appeared immediately it was forced back into the position it had just occupied.

More careful investigation showed just why this mounting was not satisfactory. Without the bolt in place and with the speaker resting on the chassis the holes in the speaker frame and chassis appeared to line up quite correctly, but as soon as the bolts were fitted and tightened the speaker was tilted forward.

This was due to the presence of a cardboard washer around the circumference of the cone and which was a good deal thicker than the metal lip on the speaker frame. As a result, this washer had been considerably compressed at the two mounting points, particularly as the area of metal chassis, due to the shape of the cut-out, was very small at these points. The washer also pressed against the inside front of the chassis at the bottom of the circumference and, not being compressed at this point, caused the speaker to be tilted forward.

Once having found the trouble, I simply passed the chassis back to its owner with a few suggestions as to how the mounting could be modified to eliminate any strain on the edge of the speaker frame, but leaving the finer details for him to work out when he decided on a suitable cabinet.

However, it raises an interesting point regarding the mounting of speakers, namely, that they should either be mounted by means of the bracket provided on the body or, when the holes on the edge of the frame are used, the pressure should been evenly distributed so that the frame is not distorted.

THIS MONTH'S TIP

PRACTICALLY every set a serviceman handles will be covered in thick layer of dust, mainly because the housewife seldom remembers to dust it or, if she does, is scared of damaging some "delicate" part. To render it sociably acceptable by means of cloths and dusters is extremely difficult and far better weapon is a small paint brush which can be used to reach all the difficult corners and crevices.

Ideally one should have two, a large one for the clear areas of the chassis and a small one for the "hard-to-get-at" parts. Keep them for this job exclusively and don't be tempted to use them for painting—the dust in them will ruin the job.

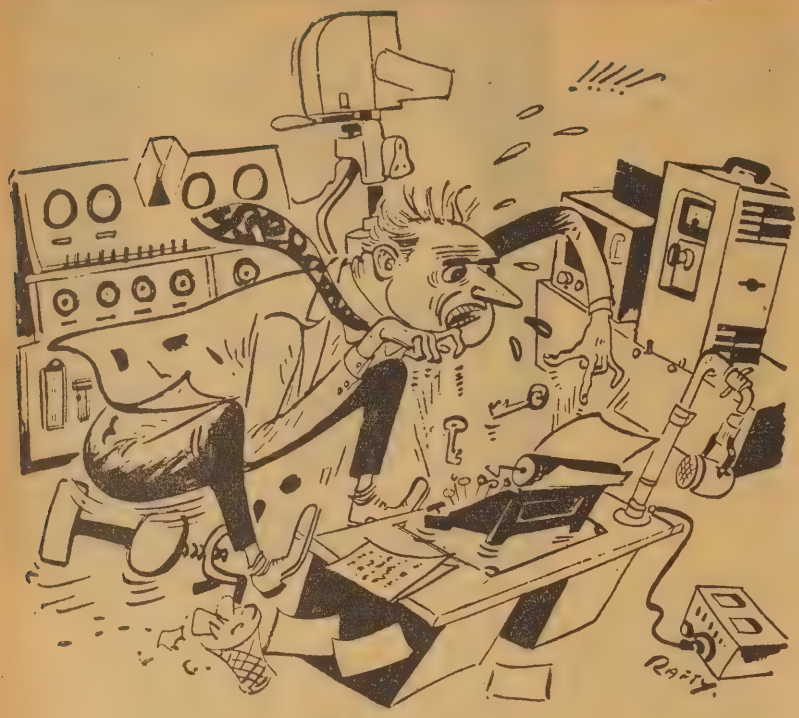
THAT VALVE!

Another story I heard this month also concerns the damage which can be done to a set by an inexperienced owner, though the results were not quite so tragic and rather more excusable than in the case of the butchered speaker.

It seems that a dear old lady owned the set in question and, in course of time, as is their wont, it developed a defect of some kind. "Dear me," thought the D.O.L., "it must have a faulty valve." (You remember it's always a valve.) "I'd better have them tested."

And so she proceeded to take the valves out of the set. The only snag was that the valves were rather tight in their sockets, but the D.O.L. was not going to be beaten and she wrapped both hands firmly around the glass envelope and heaved. (In case you have not already guessed

(Continued on Page 45.)



Let's Buy An Argument

This article may not appear to have the slightest connection with the one that went before—and the explanation is very simple. It hasn't! Because of holiday arrangements, I am writing it out-of-sequence and before irate readers have had a chance to comment on last month's effort.

by W. N. Williams

LOOKING back on all the articles written recently on tape recording, the change may not be a bad thing.

"A change is as good as a holiday," as they say. I'm personally arranging for a holiday — you can please yourself what you do with the change!

Just who the "they" might be, responsible for so many sayings and snippets of gossip, I don't know. "They" are very vague, indefinite people.

VALVES AND RESPONSE

Like some of the ideas one comes across in the course of a day's work!

There's the one I was reminded of rather forcibly last week — that valves in an audio amplifier have "a frequency response." The idea has nothing to do with self-resonance or anything as factual as that. It's just expressed in a bald statement like this:

"The old '50 is out of date now. It hasn't the response of a 2A3."

Or yet again: "I put in 6V6-G's and the response is a lot better than with the 6F6-G's.

Phooey!

Just for the sake of the record, let me state quite seriously that, by and large, in audio applications at least, valves just don't have a frequency response of their own. In terms of practical quantities they are all inherently "flat."

If you wire them into a test set and vary the grid voltage, you'll observe a sympathetic variation in plate current and the quantities won't alter markedly for any speed of alternation within the accepted audio spectrum.

This goes for triodes, tetrodes, pentodes, septodes, octodes, novatodes or dectodes!

Operated under dynamic conditions, into resistance load, the same general observation holds true. To find an exception, one would need to invoke certain high-mu triodes which, under provocative circuit conditions, begin to show some high frequency losses due to their inherent or generated inter-electrode capacitance.

But power amplifiers? Never! As valves, under likely load values, they would never show any frequency discrimination between the limits of virtual DC and "audio" too high to hear.

To find their practical limits as amplifiers, you'd have to push the signal frequency up to various numbers of megacycles. Then, and only then, might the 2A3 be better than the 50, and so on.

The catch comes, of course, when you begin to feed the valves into reactive rather than resistive loads, notably transformers and speakers. Such things undeniably have a frequency characteristic and the final result does depend to some extent on the valve with which they are associated.

REACTIVE LOADS

It becomes apparent, for example, that triodes with reactive loads give a more level output voltage than do tetrodes or pentodes. All three tend to limit the variation in response but the triode does it the most successfully.

In the combination of valve and load, the latter is the villain of the piece, and the valve is the influence for good. The final result is determined by the relationship of the load and the valve's plate resistance.

"But," you might say, "isn't that the same thing?

"Doesn't it mean that triode output valves give a more level response than pentode output valves?"

If you're prepared to combine several mental steps into one generalisation, I suppose it does mean that. But short cuts like that are the surest way I know to muddle-headed thinking. I prefer to sum up the situation this way:

SUMMING UP

(1) By and large, valves are "flat" over the audio range, power valves being the last to come into question, because of their low voltage gain and their low customary load values.

(2) Many circuit components are frequency conscious and these, not the valves, are primarily responsible for frequency discrimination. Considered together, the characteristics of the valve and the components in question determine the final result.

(3) Most of the differences which enthusiasts "notice" between valves of the same class are the product of a too-fertile imagination.

So much for that one.

Talk of output loads and their reactive qualities raises a rather interesting question which I can't recall having seen or heard debated. It was brought to mind by the recent talk about feeding recording heads, both disc and tape.

We have made the point that these heads perform "work" on the disc or tape which is largely measured by ampere-turns, or the amount of audio current which flows through the winding at the various signal frequencies.

Since the head impedance rises with frequency, then the voltage across the head should also rise with frequency to maintain a substantially constant current through the windings. This generally desirable result can be achieved either by feeding the head from a very high impedance source or from a low impedance amplifier with a rising frequency response.

OUTPUT IMPEDANCE

That being so, why is it that we bend over backwards, in designing an amplifier to feed a speaker, to keep the output impedance low, to achieve a "constant voltage" effect and avoid like a plague anything that looks like constant current.

Yet surely the active part of a speaker is a coil of wire, whose impedance rises with frequency, just like a recording head. Why not be just as meticulous, in designing the companion amplifier, to keep the current through the said coil constant with frequency?

I can only recall one instance where a line of receivers and speakers was mated on this basis. For the rest, the approach always seems to be to keep the amplifiers and speakers both on a "constant voltage" basis.

And this simply means that, as the impedance of the voice coil rises with frequency, the current through it must decrease in proportion.

At high frequencies it may fall to, say, one-fifth of the figure at the usual 400-cycle reference. Which means, in turn, that the effective power dissipated in the motional impedance would be down to something like one twenty-fifth of the reference figure.

How then can the acoustic output from a good speaker be maintained substantially level with frequency if the driving current and power in the voice coil is so drastically reduced? The answer, surely, can only be that the radiation efficiency on the front axis must rise sufficiently to compensate.

DOES THIS HAPPEN?

One might suggest the following:

(1) That, due to cone break-up, the voice coil does not need to move as much mass at high frequencies as at low frequencies.

(2) That the cone area which is active radiates much more efficiently at high frequencies than at low frequencies—or should we say couples more efficiently to the surrounding air.

(3) The natural "beaming" effect concentrates the acoustic output into a much smaller solid angle, increasing the sound intensity in a forward direction by an inverse ratio with frequency.

Something like this would have to go on, otherwise, I guess, the reproduction would always sound pretty dull. Or is there something we've forgotten?

One could, of course, begin talking about the need for loudspeaker damping, &c., but that point is not in question. Loudspeaker damping is very desirable but, while we are busily achieving it with a low source impedance, why doesn't frequency response go to the pack?

One might counter by asking what provision for damping head is made when using constant current feed, but that, once again, is beside the point. I've been thinking purely of frequency response.

There's one very interesting point that arises out of all this. What note do the manufacturers take of amplifier impedance in publishing curves? That some note must be taken is, of course, self-evident.

If a manufacturer should publish a curve or state frequency response on the assumption of a zero impedance amplifier, then the treble would be decibels up when using a high impedance amplifier. And, of course, the reverse would be true.

Apparently, they adopt the only possible course and try to anticipate the type of output stage with which certain classes of speaker would be used. Thus, little 3, 5, and 6-inch speakers would probably never be used with anything more pretentious than a single straight pentode and their response would be tailored accordingly.

SPEAKER TESTS

On this basis, you can reasonably assume that your big wide-range speaker was intended and rated to work with an amplifier having a very low impedance output — in other words, something pretty close to constant voltage.

But it's just one more doubtful quantity. Before you gaze too fervently at your favorite speaker response curve, you will now have to supply answers to the following:

(1) Does my amplifier have a similar output impedance to the one used to derive the curve?

(2) Is my speaker baffled exactly as was the speaker under test?

(3) Do my room acoustics duplicate the acoustics of the test chamber . . . a most unlikely one!

(4) Is my listening position equivalent to the position of the calibrated microphone?

(5) Is my speaker an exact duplicate of the one used for the original test?

In case you think I'm pulling your leg about the significance of all these factors, have a look at the accompanying curve. It purports to show the measured frequency response of a twin-cone wide-range speaker, mounted in a recommended baffle and as "heard" by the microphone 3ft in front of the cone axis.

In the panel is a copy of some notes I jotted down on one occasion, while talking on the phone to someone who had just completed a calibration curve

Figure 1: The published response curve of a wide-range speaker. Compare this with the summary of a curve taken of the same type of speaker in another test room.

WHAT SOMEBODY ELSE SAID:-

45 cps . . . . . Cut-off
Flat to 150 cps.
Slight fall to 3db. down at 300 cps.
Back to zero ref. at 500 cps.
Plus 5db. at 700 cps.
Zero ref. at 1000 cps.
Slight drop 1000-1500 cps.
Plus 5db. at 2500 cps.
Zero ref. at 5000 cps.
Zero ref. at 6000 cps.
Plus 6db. at 7000 cps.
Zero ref. at 8000 cps.
Zero ref. at 10,000 cps.
Minus 6db. at 12,000 cps.

Figure 2: Here's a copy of the notes I made once of another test of the same kind of speaker as depicted by the curve above. It confirms the range of the speaker but note the discrepancies due to differences in cone, room acoustics, baffling arrangements and so on.

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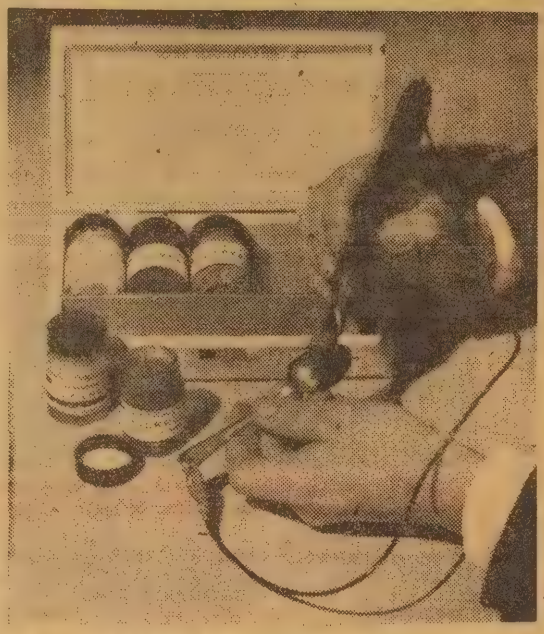

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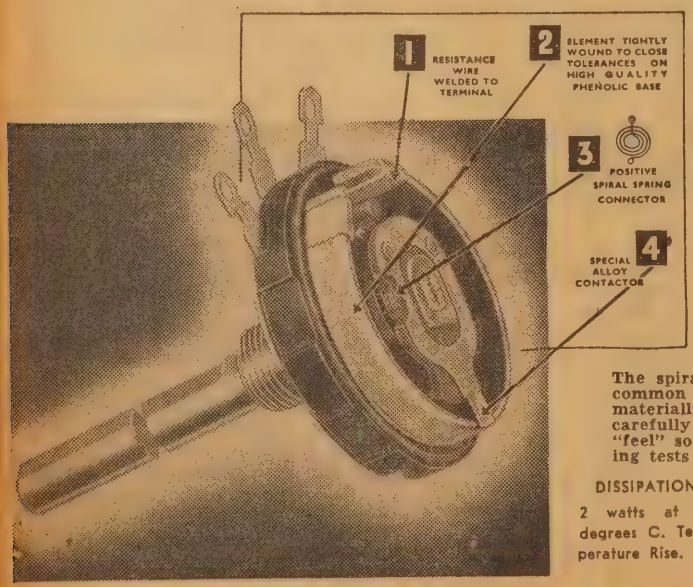

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DISSIPATION	SHAFTS	RESISTANCE VALUES	DIMENSIONS
2 watts at 50 degrees C. Temperature Rise.	¼" diameter. 3/8" bushing. Standard shaft length 2¼" from front plate to end of spindle.	All ranges from 5 ohms to 10,000 ohms. Standard tolerance plus-minus 10 pc.	1¼" diameter. Depth from mounting face, 9/16."

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on the same type of speaker. You can pick obvious discrepancies in both the extreme bass and treble, while the up-and-down wiggles in between are out of step.

Either way, there can be no doubt about the range of the speaker, and it is obviously a better job than average in this respect. But fancy quibbling about its response at 10 Kc. when the two readings disagree by 10 db!

QUIZ

And don't think I'm picking on that one speaker. Variations of that order are not uncommon at spot frequencies with any speaker.

I guess that's enough audio for the time being. Here's a little quiz problem which was put to me by confrere Phil Watson, who's also a very nasty, argumentative type.

I put it in turn to members at a Wireless Institute meeting and had to talk over a crossfire of objections.

"Try Your Skill," as they say in the sideshows.

You have a perfectly standard production type 4/5 broadcast superhet. The gang is okay, the dial glass okay, and the two are locked together in the right relationship.

The set has an aerial and oscillator coil with fixed slugs and a traditional variable padder. That's the set-up.

You set about and align the receiver on an accurate generator and everything peaks sharply at the usual spots — 455, 600 and 1200 Kc. But, unfortunately, the tuning does not now track with the dial at the low frequency end. What is at fault?

Let me whisper . . . it's one of the coils! But which one?

I'll guarantee that nine out of 10 will take a snap guess and say, "The oscillator, of course!"

THE AERIAL COIL!

But, no sir. It's the aerial coil! While you're still spluttering in protest, let's trace through the procedure.

In aligning the low frequency end of the band, you tune a specific signal and effectively keep it in tune with the padder, while rocking the gang progressively further in or further out of mesh. Ultimately, you reach a condition where the signal is at maximum strength and you forthwith observe that the padder is peaked.

Now, it's something of a misnomer to talk of peaking the padder, because its function has been to keep the oscillator on 1055 Kc. so as to beat with the 600 Kc. test signal.

The peak in the output really means that you have found a setting of the gang which tunes the oscillator to 1055 Kc. (with the help of the padder), and which simultaneously tunes the aerial circuit to resonance at 600 Kc. This latter observation gives the key to the situation.

If the dial does not track under these conditions, it means that the gang is further in mesh or further out of mesh than it should be. This means, in turn, that the aerial coil is peaking to resonance with more or less capacitance than intended. And this condition can only come about if the aerial coil has too little or too much inductance!

At which point, I think, it is appropriate to add the letters QED, standing for the Latin quotation, "quod erat demonstrandum," or something to that effect.

In plain Orstralian, or as Phil Watson put it. "That's what I said in the first place, mate."

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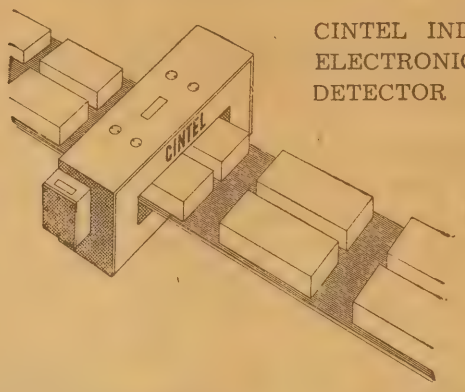
★ *Loss of customer goodwill*

. . . Caused by spurious metallic content in foodstuffs, plastics, explosives, textiles, chemicals, rubber, confectionery and almost every other non-metallic commodity.



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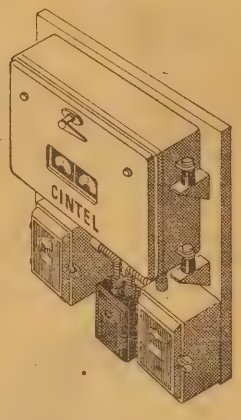

If desired an alarm is operated and the conveyor stopped. When the metal is removed the material may be reclaimed and again passed through the head to ensure that no metal remains.

FEATURES: Reliability • Automatic operation • Ultra-sensitivity • Rugged construction • No operating controls • Locates metal imbedded in commodity at any depth • Designed to fail to safety • No danger to personnel, such as exists with X-ray or radio-active inspection.

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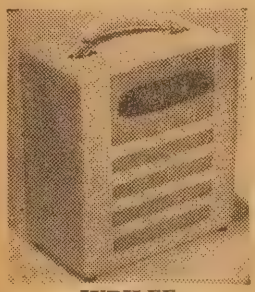
Extracts from two of the many letters received by Electronic Parts.

E.P. KITS GET RESULTS—HERE'S PROOF

These are extracts from letters recently received. Reports such as these are coming in all the time from satisfied purchasers of E.P. Kits . . .

"I have now completed building the "Carry Set" kit and I am writing to tell you how very pleased I am with it. Last night I came across a faint signal and on turning the aerial coil in the right direction found it was 2UW. Pretty good considering I live near Adelaide and the set had no extra aerial or earth.
P. J W. Woodville, SA.

"Regarding the Senior Portable kit I purchased from you . . . I consider the set will hold its own with commercial portables in the £29 to £31 class . . .
F. G. A. Woomera.



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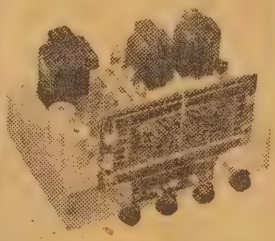

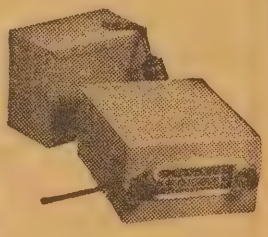

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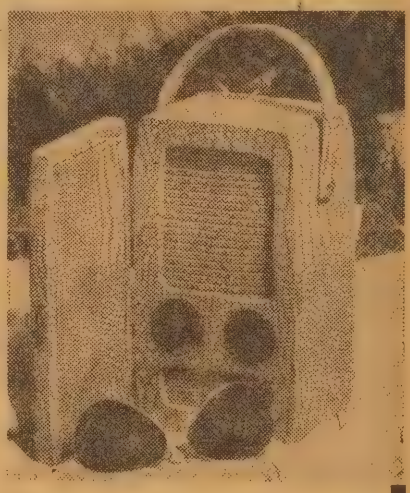

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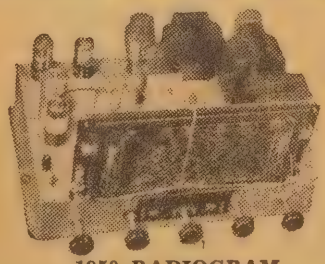

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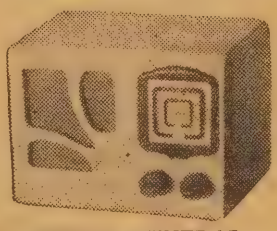

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A COURSE IN TELEVISION

PART 45—TELEVISION FROM FILMS (Cont.)

In the last issue, the possible relationship between films and television was explained and a simple system outlined for adapting a standard projector to 50-frame television requirements. Additional techniques are explained in this article, together with the problems of converting standard films to 60-frame TV requirements.

THE intermittent film scanner, as described last month, has been criticised frequently on the grounds that it does not give the consistently good definition that one would expect from a standard 35mm print.

The criticism is often based on two main grounds. In the first instance, it is suggested that erratic registration of successive frames in the film gate causes erratic placement of the interlaced scanning lines in relation to the image, thereby degrading the picture.

The validity of this contention is open to question, because experience would seem to indicate that the registration between frames with a good intermittent system is less of a problem than with other systems. Furthermore, if the image can be held steady enough for large screen cinema projection, there should be no problem in doing the same thing for a small television image.

POORER DEFINITION

What is much more to the point, the operation of the camera tube on a purely stored-image basis adversely affects the definition and gives a noticeably poor picture as compared with direct pick-up.

Whatever the individual factors involved, much effort has gone into the development of systems which allow the film to be scanned while it is moving continuously and at a carefully regulated speed through the projector.

It is possible to envisage moving mirror systems which, when suitably synchronised, provide an apparently stationary image of each frame on the picture tube screen. The difficulty with such systems, however, is to ensure sufficient optical and mechanical precision to obviate "jitter" or shaking of the image and the consequent loss of definition.

SIMPLER APPROACH

Fortunately, with the 2 x 25 frame TV systems, a simpler approach is possible. As the film moves through the machine, synchronised mirror wheels or drums flick a spot of light across the picture. The movement of the light beam is so controlled that the vertical travel of the spot added to the progressive movement of the film spaces the lines appropriately for a half scan.

During the following interval the spot traces a to-and-fro path necessary to fill in the alternate lines.

Light from the spot which passes through the film is collected by an optical system and focused on to a multiplier phototube. This generates impulses directly proportional to the light values and, therefore, to the transparency of the film.

This system obviates completely the necessity for using a television camera and therefore the serious losses involved in the image storage process already described. The difference is generally quite marked, films scanned by the flying spot technique being seen to much better advantage than those scanned by the intermittent-cum-storage process.

The need for mirror wheels, &c., has now been obviated by the introduction of the "flying-spot" scanning tube. This is a special form of cathode ray tube designed to provide a finely focused, high-intensity spot on its screen. The spot can be deflected as required by conventional timing and deflection circuits.

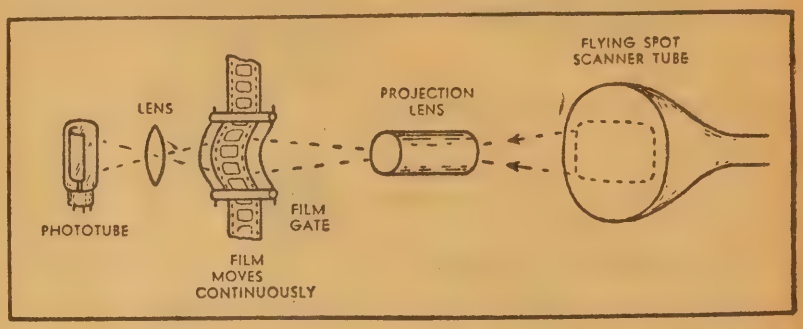

Figure 1. Possibly the simplest and most effective set-up for televising films, assuring 50 pictures per second. Picture quality is better than that from the intermittent-storage system described last month. Early systems used mirrors to deflect the "flying spot."

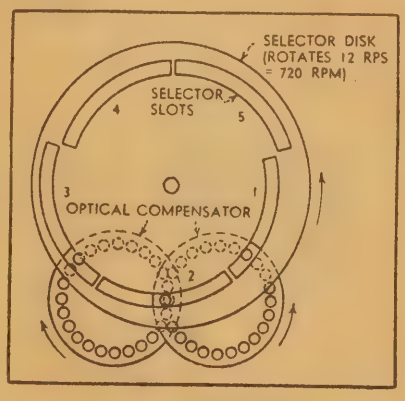

Figure 2. The intermittent-storage system as arranged to convert 24-frame films for twice-times-thirty frame television. Alternate frames are left stationary in the gate for unequal periods and a contra-rotating fan shutter is used.

In use, the flying spot scanner is set up in front of a continuously moving film and the spot is deflected electronically from side to side and up and down to a prescribed pattern (see figure 1). An image of the flying spot is focused on to the film and the combined movement of the film and spot produces an interlaced scanning pattern.

FLYING SPOT

As before, the light transmitted by the film is collected and made to energise a multiplier phototube which generates the video signal.

The flying spot scanner has the advantage of being entirely electronic in its action and therefore easily synchronised with other elements of the system. It is relatively cheap and does not involve troublesome mechanical maintenance.

As with the mechanical flying spot system, it obviates the need for storage operation and does not tie up expensive camera equipment.

NEW STANDARD?

Flying spot scanners are used extensively, also, to televise slides, &c., involving a minimum of equipment.

Since Australian proposed standards envisage a picture repetition rate of 50 per second, the type of equipment already discussed will be applicable to Australian conditions.

The notable difficulty with televising films occurs in countries like the US which have standardised on a repetition rate of twice times 30, equals 60 per second.

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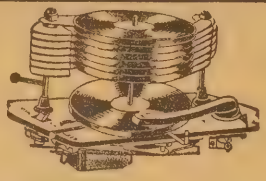

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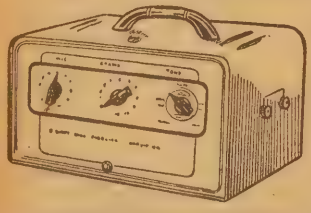

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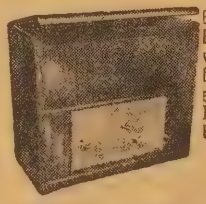

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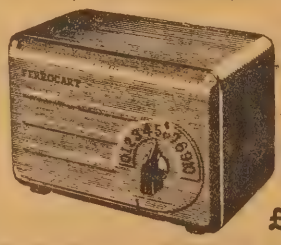

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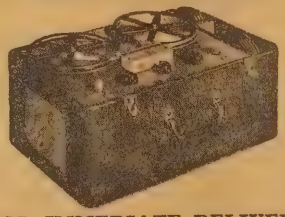

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speed up a standard film to this projection rate, because the effect on both action and sound would be hopelessly unnatural.

Nor is there any obvious way of using persistence or storage effects to a degree where they could bridge the gap between frames which are all the time changing their relative time intervals.

The difficulty is such that there has been serious discussion around the idea of producing 30-frame films for television and treating this as a new standard. While this would obviate one difficulty, it would mean automatically that US television films could not be sold or interchanged readily with television films from other countries, nor would they be interchangeable with regular cinema films.

Fortunately, there is a simple mathematical solution to the problem, as follows:

MODIFICATION

At present, cinema films are photographed at a speed of 24 frames per second and, during projection, each of these is projected twice, giving a picture repetition rate of 48.

The idea is that, while the film moves through the projector at the normal rate, alternate picture frames should be treated differently. Instead of each frame being scanned twice, one frame is scanned twice and the next three times. Each scan must, of course, be completed within slightly less than one-sixtieth of a second.

As a result of this manipulation the 24 individual frames, representing one second of running time, are made to yield exactly 60 scans, which is the figure required. The unequal treatment of the alternate frames makes no perceptible difference to the picture, while the speed of action and the pitch of the reproduced sound are held exactly to their correct values.

ORDINARY 30-FRAME SCANNER

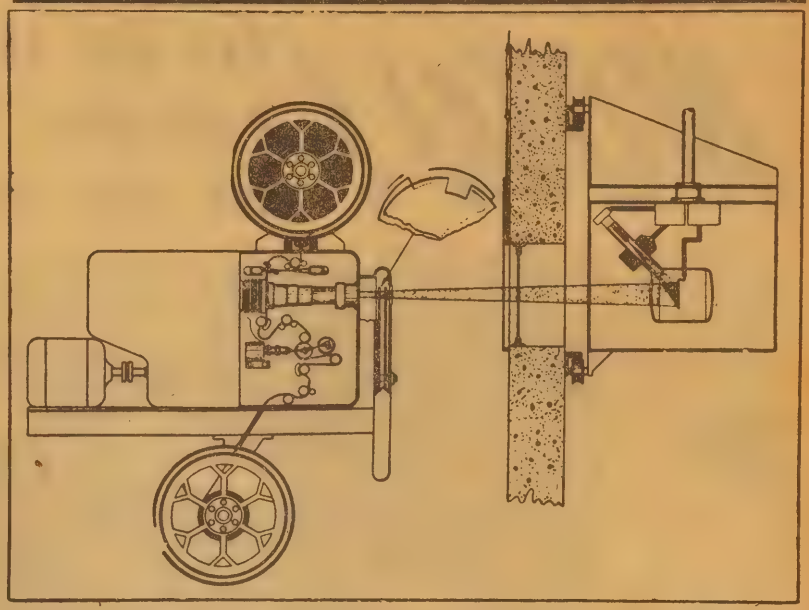

Figure 3. Illustrating the system of whirling discs which is commonly used to "stop" continuously moving film. The discs are synchronised so that one pair of lenses and a selector slot coincide with each frame of the film.

The desired result can be obtained by specially modifying a standard type of projector so that the intermittent action holds alternate frames stationary in the gate for differing periods. Figure 2 shows a typical set-up, including a two-section shutter with vanes rotating in opposite directions.

The whole system is synchronised so that light from the arc reaches the camera tube only during the fly-back period of the televison scan, the normal picture scan relying on the storage characteristic of the camera tube. In this respect, the operation is exactly parallel to the ordinary 50-line system already described.

The picture suffers the same loss

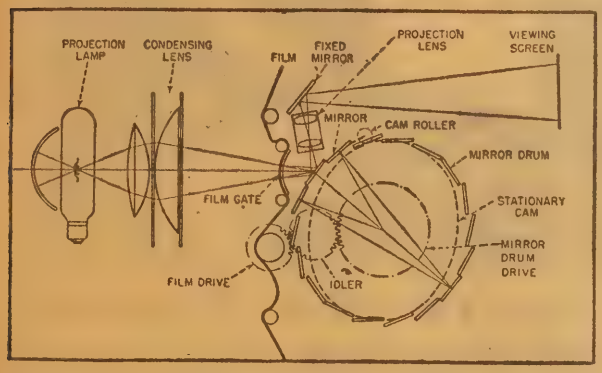

Figure 4. Illustrating the principles of a mirror drum system for projecting stationary images from a constantly moving film. Limitations of this system are a 24-cycle flicker, with possible "jitter," as in all non - intermittent systems.

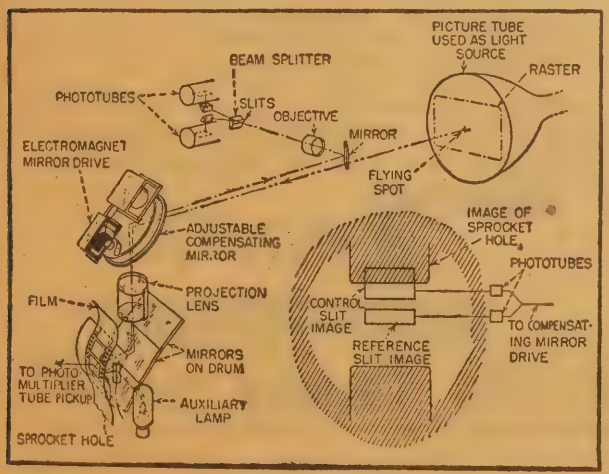

Figure 5. Showing how the system of Figure 4 can be modified to include a flying spot scanner, also a servo mechanism to cancel "jitter" due to film wander.

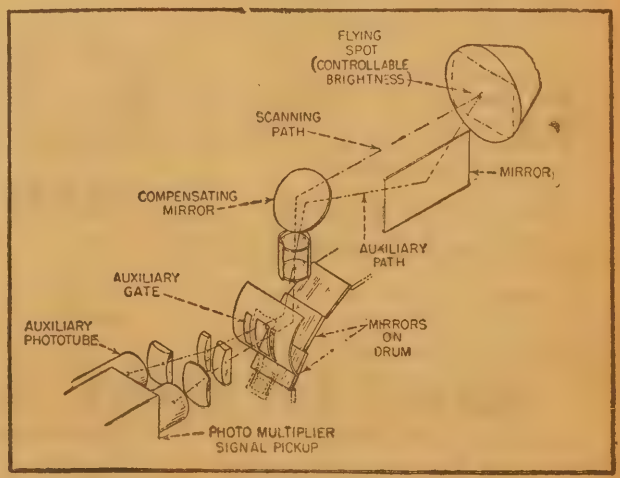

Figure 6. A further refinement to Figure 5, An auxiliary phototube, through a control circuit, intensity modulates the beam of the scanner tube and cancels the flicker.

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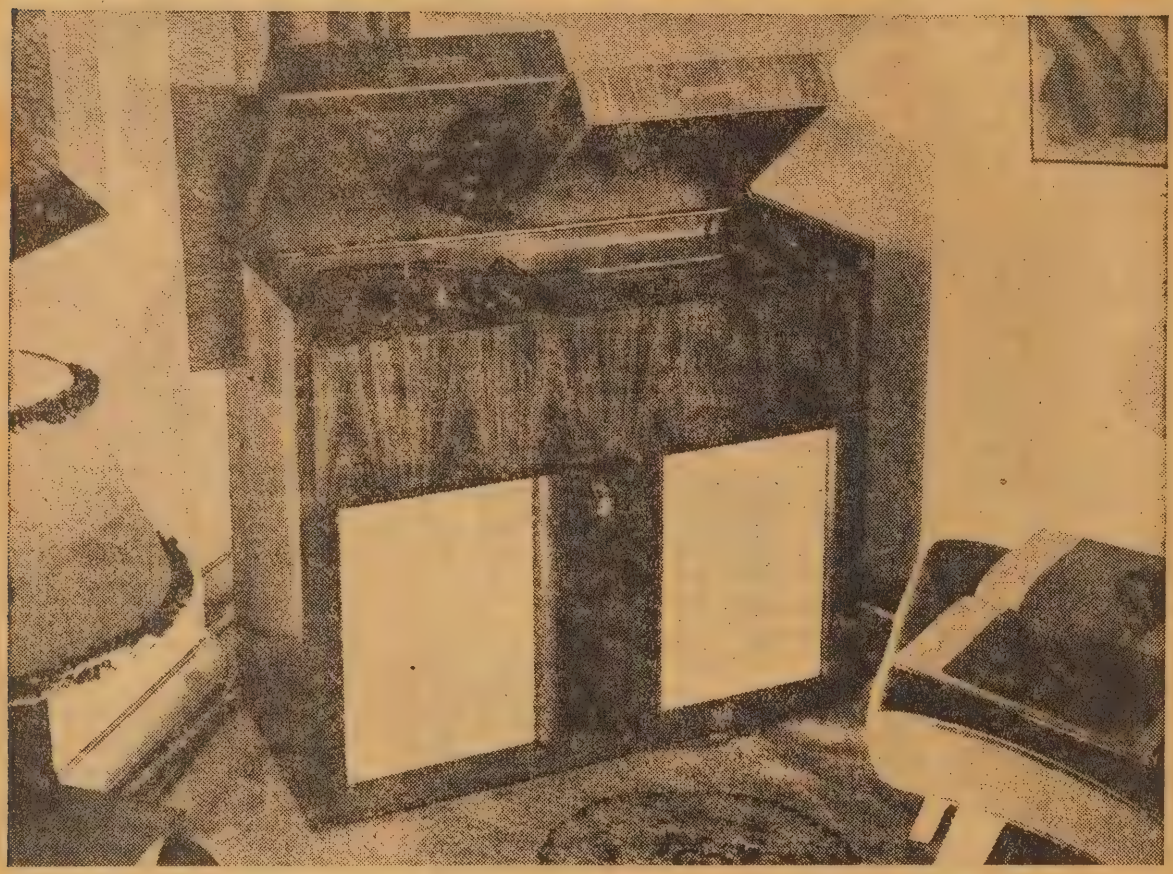

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of definition, due to the storage principle and this has led to the development of alternate scanning arrangements, which combine the necessary conversion in frame repetition rate with continuous film movement. Such arrangements can take a variety of forms, but they are all necessarily complex and require a high degree of both optical and mechanical precision.

One of the better-known systems, credited to Bamford, places three rotating discs in front of the steadily moving film, as illustrated in figure 3.

The film runs past the gate at the regular speed of 90 feet per minute equal to 24 frames. Two smaller discs, carrying a series of lenses around their periphery, rotate in opposite directions and—at a speed such that the lenses move with the film—one pair of lenses to each frame. The combined movement of lenses and film is such that a stationary picture is projected on to the photosensitive surface of the picture tube.

At the same time, the selector disc at the rear ensures that only one frame and one set of lenses is operative at any one instant.

SLOT ARRANGEMENT

The slots in the disc are so arranged that numbers 1, 2 and 3 follow one frame and divide its exposure time into three periods. Slots 4 and 5 follow the succeeding frame and from it derive two projection periods. The end result is five projection periods from two film frames, the narrow blackout between periods corresponding with the flyback pulse.

By eliminating the need for storage operation of the picture tube, the definition from the electrical standpoint is very much improved. However, a very high degree of optical and mechanical precision is necessary to avoid "jitter" of the image and consequent loss of definition. This is true of all such systems.

A more recent development, credited to the Bell Laboratories, uses a mirror drum system to "stop" the image on the film, together with an automatic servo arrangement to hold everything more precisely in register.

Figure 4 shows the basic idea. The film is moved continuously through the projector and runs over a curved film gate. Light from the projection lamp passes through a condenser, through the film and on to a series of mirrors mounted around the edge of a drum.

ANGLE OF TILT

The mirrors are free to pivot on the drum surface, their angle of tilt being controlled by individual roller cams running on a large inner fixed cam. The drum has a total of 18 mirrors around the periphery and rotates at 80 rpm, so that it provides one mirror for each picture frame on the film.

The whole thing is so timed that the travelling mirrors reflect a stationary frame image up through the projection lens, on to a fixed mirror and thence on to a viewing or TV screen.

There are two limitations to the usefulness of the mechanism in its simplest form:—

In the first place it is prone to the same "jitter" effects as other continuous film projectors, and would normally require the same costly maintenance. Secondly, the function of the mirrors overlaps to some extent so that individual pictures, for a brief period, are built up by rays from two mirrors, thereby increasing the picture intensity.

This leads, in turn, to a flicker at the frame rate of 24 per second—a very objectionable feature. Refinements have been added, however, which automatically overcome both difficulties. Both refinements involve the use of a flying spot scanner tube and photomultiplier rather than the traditional projection system of figure 4.

To control "jitter" effects, the optical system is widened so that, while projecting an image of the flying spot through the film for the video signal, it also carries in the reverse direction a stationary image of the sprocket holes down one side of the film. This sprocket-hole image travels through the projection lens, at a slightly oblique angle, is diverted by the main 45-degree mirror, thence via another mirror and a prism to a pair of phototubes. (See figure 5).

The image is so masked that, under ideal conditions, the light from a control slit exactly balances that from the reference slit. Any short-term wander in the film speed causes the supposedly stationary image of the sprocket hole to wander, thereby unbalancing the light reaching the two phototubes.

The unbalance is applied to tilt the main angle mirror sufficiently to restore equality and this tilt also modifies the image position of the flying spot by the same amount, thereby offsetting the wander in the picture also.

Since the correction required is only very small, it can be effected in something like one millisecond and the total resultant wander of the image is reduced to less than half the thickness of a scanning line. This is well inside accepted tolerances.

A somewhat similar device is used to offset the flicker.

Light from the flying spot scanner is picked up by a side mirror and reflected obliquely through the optical system, clear of the film on to an auxiliary phototube. This light is not affected in any way by the film but it is affected by the action of the mirrors which periodically transmit two images of the spot rather than one.

FLICKER CANCELS

The resultant periodic variation in brilliance, equal to the aforementioned 24 cycle flicker, is applied through a phototube and control circuit to modify the intensity of the flying spot. Thus, at the very instant when two mirrors begin to combine in their effect, the intensity of the spot is modulated downward, keeping the total apparent illumination effectively constant.

It will be obvious to the reader by now that the two systems outlined for scanning a continuously moving film are by no means the only ones that could be used. One could visualise many possible variations or combinations of method. They will suffice, however, to illustrate how a rather vexed problem can be solved.

In the long run, of course, such problems will concern only the station engineers, not those whose main job it will be to design or construct or service television receivers. Nevertheless the whole subject has been reckoned sufficiently interesting and sufficiently important to warrant treatment in this series of articles.

FROM THE SERVICEMAN WHO TELLS

(Continued from Page 35)

it, the valves were of the P base variety.)

Eventually her efforts were rewarded and she had extracted all six valves. Funny thing, though, only four appeared to have bases. Of the remaining two, one had some thin copper-like wires protruding from the bottom of the envelope and the other had nothing. This puzzled the D.O.L. somewhat, and she doubted her ability to put these valves back in the set, but decided that the man at the radio shop could probably help her in this regard.

THE MISSING BASES

So she wrapped the valves up very carefully and toddled off to the radio shop where she asked the man to test them. The "man" happened to be the friend who told me this story and he was horrified to realise that two P type bases were still sitting snugly in the sockets of the set.

What was worse was the fact that the valves were almost impossible to replace and, while the one with wires protruding from the envelope looked as though it might be salvaged, the other, a C8 current regulator, appeared to be a hopeless case. Only two wires were involved, it being a simple resistance lamp, but these had broken off just below the glass pinch and, although there was enough of them remaining to allow joining a new piece, they were almost inaccessible, being a couple of inches inside the thin glass channel below the pinch.

Since this glass channel was only about a quarter of an inch in diameter my friend did not relish the idea of making a couple of soldered joints at the end of it. Nevertheless, he decided to have a go at it, reasoning that there was little to lose, while the alternative was an expensive alteration to the set.

First point was to determine whether the broken wires could be reached with a soldering iron and, if so, whether they could be soldered. It was obvious that no ordinary soldering iron would do, so my friend set to and made one specially for the job. This consisted of a length of 16-gauge tinned copper wire wrapped firmly around the tip of a quick heating soldering iron and extended for about two inches to form a new, very fine, bit.

It was impossible to reach the wires to clean them, so my friend had to content himself with giving each a smear of soldering paste and hoping that this would be sufficient. Fortunately, it was, and the improvised soldering iron was able to deposit a coating of solder on each wire. With this much achieved the position began to look brighter and preparations were made for the next step.

(Continued on Page 71)

Here's your answer, Tom!

Some of the questions in this month's list come from readers in New Zealand. It is gratifying to note that Tom's fame has spread across the Tasman. Possibly there are readers in other countries who would like to contribute. If so, there is no reason why not. Send the query, marked "Answer Tom," to the Technical Editor, Radio and Hobbies, BOX 2728 GPO, Sydney, Australia.

READERS in our neighbor countries may have some interesting and unusual aspects of the hobby to contribute. We will look forward to their letters and also from all our usual readers.

And so to Tom's queries for this month:

Could you please explain a "whistle filter"?

If Radio and Hobbies were not a technical magazine we would suspect that you refer to a device to prevent rude young men expressing their reactions to the scenery as it walks by.

A hefty representative of the law may then sometimes be described as a "whistle filter."

However, knowing that you do not refer to any such thing we can explain that a whistle filter is a device for preventing a special high pitched whistle which frequently occurs in high fidelity receivers.

Broadcast stations in this country are allocated operating frequencies throughout the band, each station differing from its neighbor by 10Kcs.

By the well known heterodyne principle, a 10Kc beat note is produced when the two stations are received simultaneously by the one receiver.

In the case of most superhets with a 455Kc IF channel the selectivity is comparatively high and when tuned to a particular station the response to a station in the adjacent channels is negligible.

But when an attempt is made to obtain superior quality reception by broadening the response characteristic, a beat note may be heard in the output. It takes the form of a piercing whistle which can be most annoying. Its pitch is always 10Kc.

One cure is to insert a sharply tuned circuit somewhere in the audio amplifier circuit such that all frequencies other than 10Kc will be passed freely. In practice, it is impossible to design a circuit which will reject only 10Kc and have no effect on frequencies on either side.

With care the filter can be designed so that attenuation at 9.5 and 10.5Kc is low while there is a very good dip at 10Kc.

An ordinary top-cut type tone control could be made to act as a whistle filter of sorts. The disadvantage here is that the attenuation is gradual, and as well as losing the offending whistle you also lose some of the high frequency notes which lend the reproduction reality.

After all, that is the reason for using a broad band receiver in the first place.

What is the difference between a choke and a coil?

There isn't any difference, Tom, except that by common usage we generally imply an inductor associated with a tuned circuit when we speak of a coil, while a choke generally implies something associated with filter circuits. There are exceptions, of course.

Would you please tell me where I could obtain a glossary of radio terms?

We can't recall any book devoted exclusively to a glossary of radio terms, Tom. Actually, we don't imagine that there is a sufficient number of terms peculiar to radio to warrant such a book.

However, radio shares a lot of technical terms with other sciences and everything you are likely to need will be found in a good technical dictionary.

Alternatively, if you are stuck for the meaning of a particular word, look it up in the index of one of the standard handbooks.

In a reaction circuit why does the energy fed back into the grid circuit not cause distortion or double speech? The current in the valve and regenerative circuit must take some time, however small, to flow. Therefore the energy fed back must arrive a fraction of time after the original fluctuation has been impressed on the valve.

It is true, Tom, that signals impressed on the grid of a valve take a finite time to pass through the valve and return via the regenerative circuit, but this time is so small compared with the time taken by the sharpest sound impulse that in most cases it may be neglected.

One megacycle per second is quite an ordinary radio frequency and 10Kc is a fairly high audio frequency. Yet it would take 100 alternations of the radio frequency carrier to describe one cycle of the audio note. It takes much less than 1-millionth of a second for the amplifying action of the valve to take place, so you can see that there is little chance of the modulation being affected by the regeneration in this way. However, regeneration detectors do sometimes cause distortion for other reasons.

We are told that an electric current is a flow of electrons negative to positive. I read recently . . . "choke usually placed in the negative lead since it is then not at a high DC potential to earth." Is this right, please?

You seem to be a bit twisted up somewhere, Tom. It is true that an electric current is a flow of electrons from negative to positive. It is also usually true that a choke placed in the negative high tension lead is not at a high potential with respect to earth.

What we don't see is how you manage to connect these two facts in this way.

Possibly it is that you don't understand what is meant by potential.

About the easiest way to give you a mental picture of what happens is to explain the analogous case of water flowing in a pipe. Here an analogue for electric current is rate of water flow in so many gallons per minute. Resistance may be likened to resistance to the flow of water as may be caused by a small diameter pipe.

Potential, or voltage, is then equivalent to the pressure in lbs per square inch, causing the water to flow.

With a given resistance, the higher the potential the greater the current. Also, the greater the pressure the greater the strain on the pipes and the more likely they are to burst.

In the electrical case, if you wish to avoid strain on the insulation of the filter choke, it can be placed in the negative lead if the negative end of the supply is earthed. In practice there is little difficulty in providing adequate insulation for the windings of the filter choke and it is frequently more convenient to place it in the positive lead. In either case the current has to flow through the choke and the filtering action is the same.

Remember also that an electrical circuit must be complete before an electric current can flow.

Is the Radio and Hobbies tape recorder very difficult to make?

That's a pretty general sort of question, Tom. Before we could answer it properly we would need to know just how much experience you have had with these matters.

The tape recording amplifer recently described does not involve any radically new techniques. The switching is a little more difficult to sort out than, for example, the switching of a dual-wave receiver. Even so, if you have had the experience of building a couple of sets and are prepared to take the trouble to understand how it works you should be able to turn out a satisfactory amplifier.

The tape deck is a different kettle of fish. It requires some degree of mechanical skill and unfortunately we can see no way of avoiding this. Anything simpler to make would not be satisfactory.

If you don't feel completely confident of handling the whole job yourself perhaps you could get a friend to help you over the sticky parts. Even if you have to pay him you should still be able to get the recorder for a reasonable sum.

Before you go any further, we suggest that you make a very careful study of Neville Williams' article on the subject so that you will know exactly what is involved.

What are the chances of a radio catching fire?

As with any electrically operated device there is an element of fire risk in the case of a radio. However, it is a long time since we heard of anyone's home being burnt down by a fire caused by a radio, so that you needn't worry unduly.

FREQUENT OFFENDERS

More frequent offenders are things such as radiators, irons, toasters, jugs and other items which dissipate large amounts of heat.

Electric lamps are safely sealed away in a glass container and are unlikely to be responsible for fires, unless perhaps material with a low ignition point is allowed to touch the globe.

The power involved in the operation of a receiver is comparatively low and is spread over a number of components so that the temperature of any one exposed component is not great.

Faults within the set may cause overheating of resistors, condensers and other small components but as these are usually surrounded by non-inflammable materials, the chance of an outbreak of fireworks spreading is not good. A short in the high tension lines places a heavy load on the rectifier valve and also the power transformer. Frequently the rectifier valve fails first. Any fireworks is nicely bottled up and does not do any harm other than to the valve.

On the other hand, the power transformer may be the weaker component. Excessive current flowing in the windings will cause them to overheat. If the overload be continued the heat developed in the transformer will eventually cause the wire in the primary winding to melt. Of course, when the wire melts the overload is automatically disconnected.

An extreme overload will cause the transformer primary to become open circuit within seconds. The amount of heat dissipated will not be great and in turn, the temperature rise will be small.

However, if a more moderate overload be applied the transformer may have time to get very hot before it burns out. The chance of the paper pitch, &c., used for insulating and sealing the windings catching fire is then very much greater.

A set housed in a wooden cabinet would be more likely to assist the fire to spread than a set with a bakelite or non-inflammable cabinet. In the case of battery operated sets, the amount of power involved is so low that the chance of their starting a fire is small. Possible exceptions are high power vibrator operated receivers.

Faulty power cords, plugs, mains switches, &c., are just as likely to cause trouble as the set itself so be careful to keep them in order. Frayed cords can be temporarily patched with adhesive tape but replace as soon as possible with new.

Fire insurance people don't charge an additional premium if you have a radio so we don't think that the overall risk is very high.

What is the difference between a volume control and a gain control.

There really isn't any difference, Tom. A volume control controls gain and a gain control controls volume in many cases.

The control in an ordinary receiver controls the degree of amplification, or gain, between the aerial terminals and the speaker. With a given signal level, the greater the gain the louder will be the sounds produced by the speaker.

Most people are interested in the fact that the final effect of the control is to vary the volume and, therefore, for ordinary everyday use it is best called a volume control.

In the case of a cathode ray oscilloscope the effect of a gain control is visual rather than aural so that it is better to speak of a gain control.

Communications type receivers frequently have two or more controls each affecting the gain of a different section of the receiver. Rather than talk about volume controls it is better to speak about RF gain, audio gain, &c. After all anybody handling a communication receiver is likely to have some small technical knowledge.

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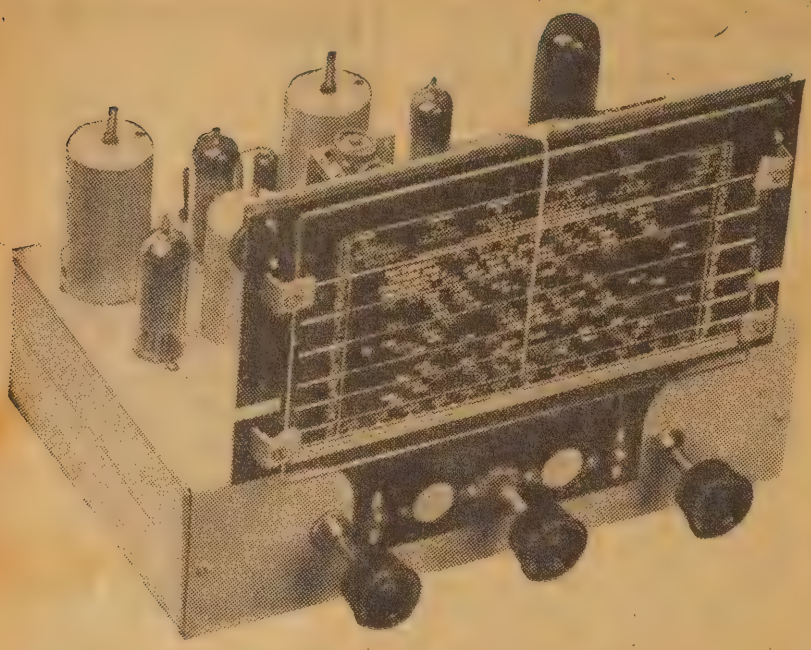


The set is easy to assemble, as well as being simple to wire. We have deliberately avoided the use of the small 7-pin button bases with this object in view. Controls are "Volume" on the left, "Tuning" in the centre and "Tone" on the right.

ANYONE CAN BUILD THIS SET

Of all the standard 4/5 superhets which have been described, you will find that this is one of the easiest to build. It is presented in such a way that any newcomer to radio may attempt its construction with every confidence. All you have to do is to read the text, study the photographs and follow the diagrams. The set itself is capable of excellent performance and will compare most favorably with commercial sets of similar design.

by Raymond Howe

THERE are many people who would like to build a radio set, for reasons ranging from the need to avoid expense to the desire to satisfy an urge to "build something" for oneself.

Whatever the reason, a lot of potential constructors or radio hobbyists, as the case may be, are baulked by the apparent complexity of a radio with all its wires and "bits and pieces." It tends to be veiled in mystery, based on that invisible "thing" called electricity.

NOTHING FRIGHTENING

This need not be so. There is nothing frightening about a standard radio. It is not necessary to know how or why a particular component functions. One has only to place all such components in certain positions and connect them together. All one need have is the ability to make a soldered joint and to read written instructions. Radio is sufficiently well established now for a home-constructor to build a standard set without having to take a chance on whether it will work.

We have always tried over the years to make the "game" easier for the home constructor. For those who want to build up experience in the hobby, we have featured constructional articles, beginning with the simplest set and ranging to a standard mantel superhet.

These constructional articles have included a wiring diagram, showing where each wire is connected and the relative position of each component. In the July, 1950, issue we went further than usual in the description of a simplified five-valve broadcast superhet. and devoted most of the text of the article to covering almost every point which the constructor would encounter.

In this, our new simple superhet., we have attacked the job from a slightly different angle. The chassis has been laid out so that every minor component would be seen in the underchassis photograph and everything would fall into its indicated place without overcrowding. Further, we have divided the underchassis wiring diagram into two stages to lessen confusion in marking off each wire and component as it is installed.

If you have not delved into radio before, you have only to identify components for what they are. You should have no difficulty, as most of them are marked and any doubt would soon be cleared up by your radio dealer.

COMPONENT CODING

We have included a resistor color code to help you in selecting the indicated resistor value for each position. Power transformer leads are identified for you by the manufacturer. Coil and IF transformer connections are marked and you have only to relate them to the markings on the wiring diagrams.

All in all, it is merely a matter of carefully surveying the job and, with the aid of the diagrams and photographs, going through the construction step by step.

Only simple tools are required. These would be a medium-size and a small screwdriver, a pair of long-nosed, side-cutting pliers, a knife, a soldering iron and resin-cored solder.

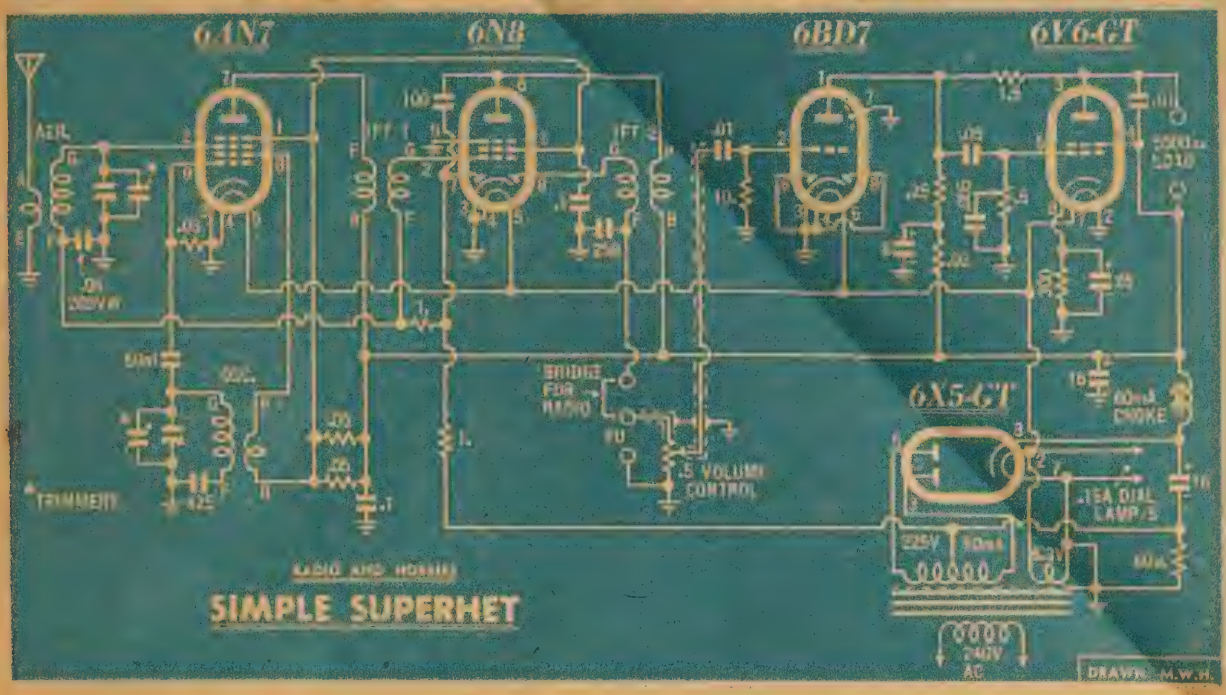
A blueprint of the chassis, with all holes and cut-outs, has been made available to the chassis manufacturers who will market the ready-made chassis through the radio supply houses. If you wish to make up your own chassis, the same blueprint is available through our Query Service, details of which are published in the panel on the Answers to Correspondents page in each issue of the magazine.

TO THE TASK

So, now let's make a start.

You will observe that it is possible to mount the valve sockets, coils and IF transformers in either of two positions. With each mounted in one particular way, the wiring of the set will be easier and there will be less chance of running into trouble. You will see from the wiring diagrams the suggested "lay" of these items. The reference point of the miniature valve sockets is the gap between pins 1 and 9, while with

CIRCUIT USES A MINIMUM NUMBER OF COMPONENTS



The circuit is electrically sound but not pretentious. All components are operating well within ratings so that, if wired carefully, the risk of breakdown is very remote. Compare this circuit with the wiring diagrams which follow.

the octal-based sockets it is the direction of the keyway in the socket.

We have identified the pins of the coils and IF transformers with the usual "G," "F," "P" and "B" in both the circuit and wiring diagrams. Some brands have this form of coding, while others may have the connections numbered with the connection code printed on the side of the metal can.

In this set, "F" means AVC line, except with IF transformer No. 2 (IFT2), where it means diode load or volume control in this case. "B" means the high tension (HT) line. "G" and "P" mean "grid" and "plate," respectively.

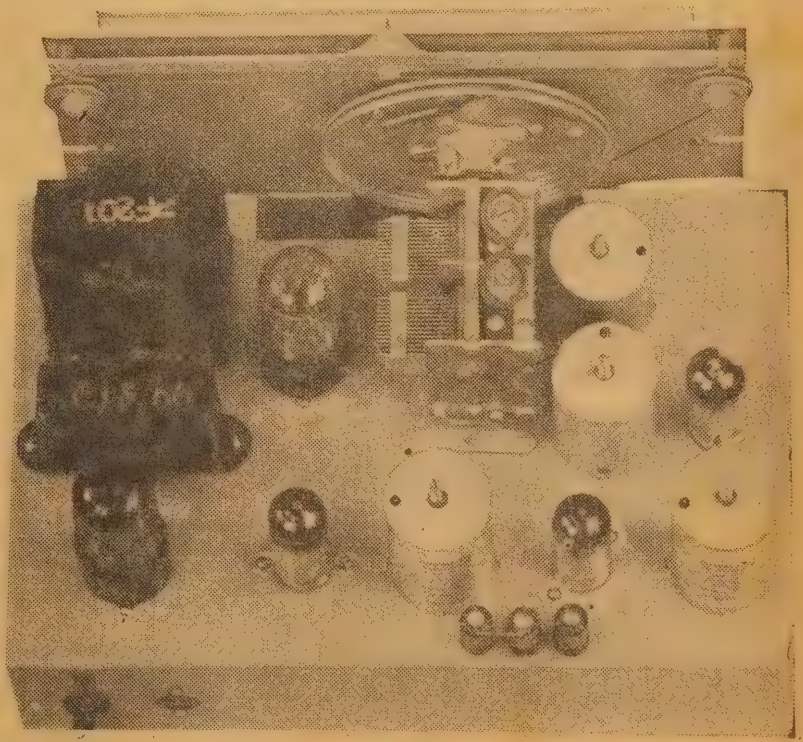
POWER TRANSFORMER

With the power transformer, simply identify the leads from the color code supplied with it, feed them through the holes indicated in the wiring diagram and secure the transformer in place. Before fitting the filter choke, solder a couple of leads to it of appropriate length, twist them together and feed them through the allotted hole. Use suitable rubber grommets in the three holes in the chassis through which the leads from the filter choke and the power transformer are fed.

Before placing the nuts on any of the bolts holding the major components, take a look at the "first stage" wiring diagram to see if that particular bolt carries a solder lug or tag mounting strip. As the nut is being tightened, lay the solder lug or tag strip in much the same position as the diagram indicates. You will see why when you start soldering.

Make sure that the head of a bolt or nut, whichever the case may be, makes good contact with the chassis by scraping any paint or oxide away from around the hole.

The tuning gang is supplied complete with mounting feet or brackets. While it is possible to mount the gang in one of two ways, you will see from the photographs which is the correct way for this layout. The moving or rotor plates



The aerial coil is alongside the gang, just behind the dial. Behind it is the oscillator coil. IFT1 is at the lower right corner, IFT2 near the rear centre. Don't allow the chassis to rest on the adjusting slugs atop these components.

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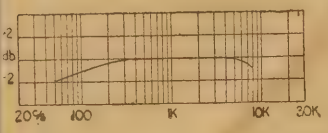
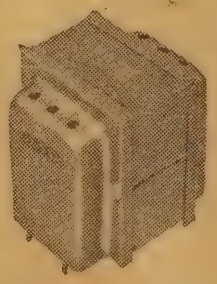
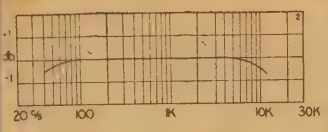


Code No.	Watts	PRIM. Z.	SEC. Z.	Retail Price
OP-1	10	5000, 2500 SE	12.5, 8, 2.3	64/3
OP-1A	10	5000, 2500 SE	500	64/3
OP-2	15	5000 PP	12.5, 8, 2.3	99/1
OP-3	15	6600 PP	12.5, 8, 2.3	99/1
OP-4	15	10000 PP	12.5, 8, 2.3	99/1
OP-11	25	6600 PP	500, 250, 125	119/7
OP-12	25	10000 PP	500, 250, 125	119/7
OP-15	32	6600 PP	500, 250, 125	144/11
OP-16	32	10000 PP	500, 250, 125	144/11
OP-37	80	6400 PP	500, 250, 125	207/-

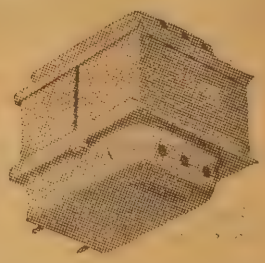


MEDIUM FIDELITY RANGE
40-12000 C/S ± 1 dB

This range has been especially designed for use with the Rola 12-OX speaker. These transformers are especially suitable for use with triodes.

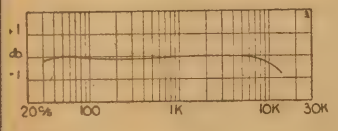


Code No.	Watts	PRIM. Z.	SEC. Z.	Retail Price
OP-112	6	10000 PP	2	92/-
OP-113	6	5000 SE	2	92/-
OP-117	6	5000 PP	2	92/-
OP-118	6	8000 PP	2	92/-
OP-119	6	6600 PP	2	92/-
OP-183	6	7000 SE	15, 2	130/10



HIGH FIDELITY RANGE
30-15000 C/S ± 1 dB

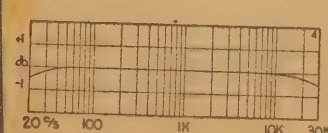
These transformers are primarily for use with Goodman and other extended frequency response speakers. Section below is only small part of our range.



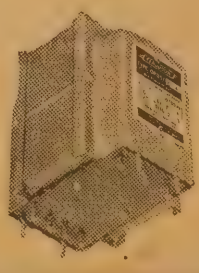
Code No.	Watts	PRIM. Z.	SEC. Z.	Retail Price
OP-22	10	3250 SE	500, 125, 2.3	101/2
OP-23	10	3250 SE	12.5, 8, 4, 2.1	101/2
OP-19A	15	5000 PP	12.5, 8, 2.3	147/2
OP-19B	15	5000 PP	500, 250, 125	147/2
OP-21	15	8000 PP	500, 250, 125	116/11
OP-62	15	10000 PP	500, 125	152/11
OP-63	15	10000 PP	15, 3.75	152/11
OP-64	15	10000 PP	12.5, 3.125	152/11
O-65	15	10000 PP	8.4, 2.1	152/11
OP-51	20	4500 PP	15, 12.5, 8.4, 6.5, 3.4, 2.7, 2.3, 2	134/4

SPECIAL HI-FI RANGE
20-30000 C/S ± 0.5 dB

These transformers are for use in the Williamson Amplifier, and fulfil every requirement specified by D. N. T. Williamson.

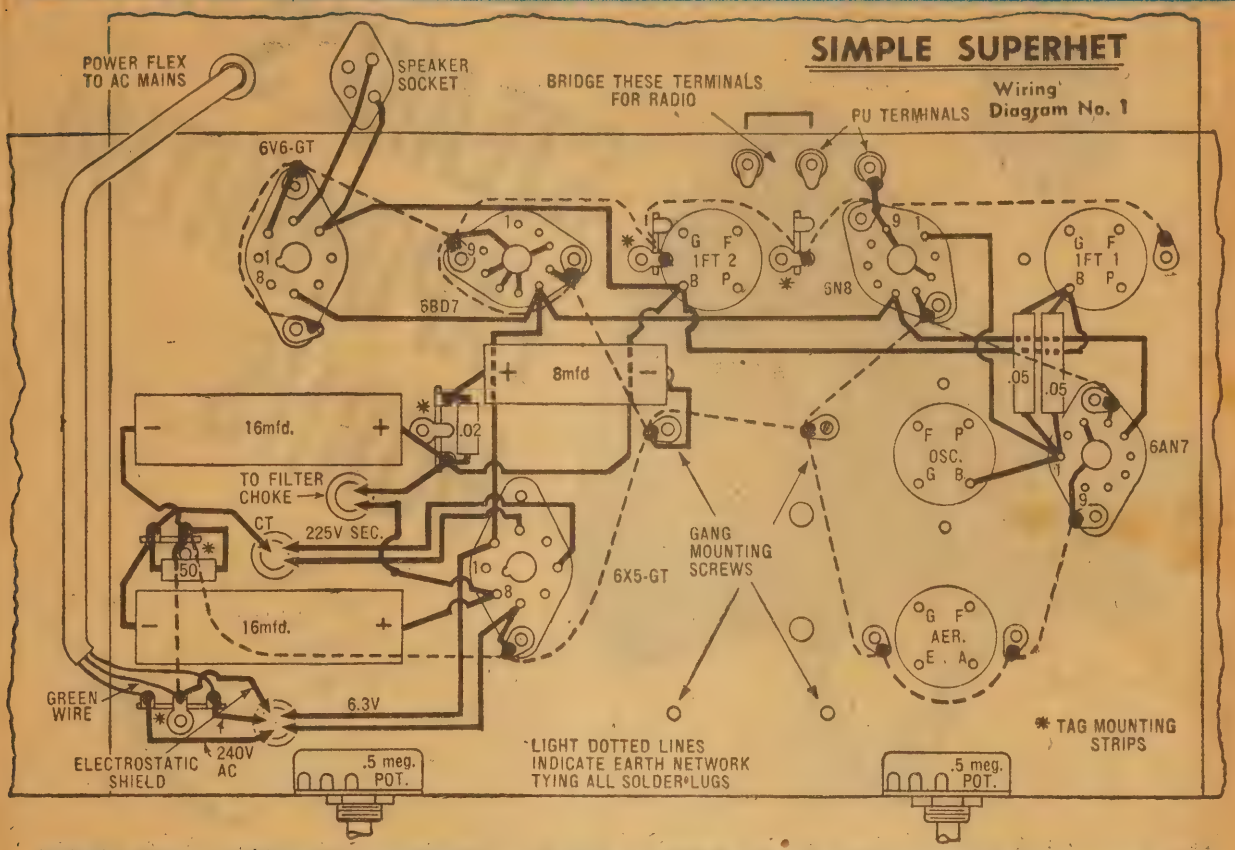


Code No.	Watts	PRIM. Z.	SEC. Z.	Retail Price
OP25/500	15	10000 PP	500, 125	180/11
OP25/250	15	10000 PP	250, 62.5	180/11
OP25/40	15	10000 PP	40, 10	180/11
OP25/16	15	10000 PP	16, 4	180/11
OP25/15	15	10000 PP	15, 3.75	180/11
OP25/12	15	10000 PP	12, 3	180/11
OP25/10	15	10000 PP	10, 2.5	180/11
OP25/8.4	15	10000 PP	8.4, 2.1	180/11
OP-66	15	5000 PP	8.4, 3.7	192/5
OP-67	15	5000 PP	15, 6.5	192/5



Ferguson Transformers Pty. Ltd., Ferguson Lane, Chatswood—Phone JA2878. Available from retailers in every State.

LAYOUT OF COMPONENTS, WIRING PARTLY FINISHED



Study this diagram carefully before assembling the set, to make sure that all coils and sockets are mounted right way round. Make sure that you do not confuse the polarity of the electrolytic capacitors, one end always being red or marked "positive." The dotted line represents the earth busbar connecting all solder lugs.

will open upwards, out of mesh with the fixed or stator plates. The bolts securing the rear foot of the gang carry solder lugs under the heads.

Note that two of the three terminals at the rear of the chassis should be insulated from the chassis with the washers supplied.

Before fitting the two controls and the dial, it is a good plan to cut the shafts to the desired length to fit the cabinet, if you have it on hand. If not, you may as well cut them to the same length as the dial shaft for the time being.

EARTH NETWORK

The first act with the soldering iron should be to connect together all solder lugs and earth tags of the tag mounting strips with a run of light gauge tinned copper wire. This obviates trouble from possible bad earth connections with the chassis, either initially or in the dim future.

Now, move to each valve socket and connect the centre spigot (in the case of the three miniature nine-pin sockets) to the earth network, one heater pin to the adjacent solder lug, and the appropriate pins to the centre spigot as indicated.

From here on, it is simply a matter of studying the "first stage" wiring diagram, marking off each wire and component as you lay it in place. If you have different colored hook-up wire on hand, it is handy for checking or later reference to use one color for the HT wiring, one for the heaters, one for the screen grids and oscillator anode, and, in the next stage, one for the grid and AVC wiring.

Note that the electrolytic capacitors have a certain polarity, one end being colored red or marked "positive." The polarity is also marked in the diagrams.

We have shown a three-core power flex for the connection between the power transformer primary winding and the power mains in the interests of safety. The green core should connect to the earthed tag of the mounting strip at the set end, and to the "earth" pin of a standard three-pin flat power plug at the other end.

RESISTOR COLOR CODE

VALUE	BODY	END	DOT
10 megohms	brown	black	blue
1.5 megohms	brown	green	green
1 megohm	brown	black	green
.25 megohm	red	green	yellow
.05 megohm	green	black	orange
.02 megohm	red	black	orange
300 ohms	orange	black	brown
50 ohms	green	black	black

The "first stage" wiring diagram covers the wiring of the power supply, the heater circuit and the DC feed to all stages. The "second stage" wiring diagram takes over from this point and shows the RF, IF and audio wiring and associated components. For the sake of clarity, all information contained in the first diagram is omitted from the second diagram.

Tubular capacitors have a line printed or a small "blob" moulded near one end. This indicates that that pigtail connection is the one which connects to the outside foil of the capacitor. In the case of the two .1 mfd and the .05 mfd 200VW connect this pigtail to the chassis.

In this stage of the wiring, keep the grid and plate leads tucked close to the chassis to avoid undesirable coupling between the input and output of one or more stages.

6N8 SOCKET

The two one megohm resistors at the socket of the 6N8 should be placed where shown and not allowed to stretch across the socket. Where you consider it necessary, slip some insulated sleeving, called "spaghetti," over the trimmed leads of resistors and capacitors.

The leads to the volume control should be shielded to avoid audio instability and possible hum pick-up. Shielded hook-up wire is readily available. Cut each lead to the required length, and, with a sharp spike, unravel the shielding braid until you have enough of the inside insulated wire free to avoid the braid touching a connection. Twist the unravelled braid into a pigtail and use as a means of connecting the braid to an earth tag as shown.

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SCIENTIFICALLY DESIGNED FOR CONTROLLED SOUND DIRECTION

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Constructed from aluminium, these horns are completely corrosion proof.

The wide frequency range covered makes them ideal for applications where both speech and music have to be reproduced at high volume levels or under difficult acoustic conditions.

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Type	S501	S502
Speaker Size Required	8 inch	12 inch
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Overall Length	16½ inches	25 inches
Diameter at Mouth	18 inches	25 inches
Weight without Speaker	5 lb.	10 lb.

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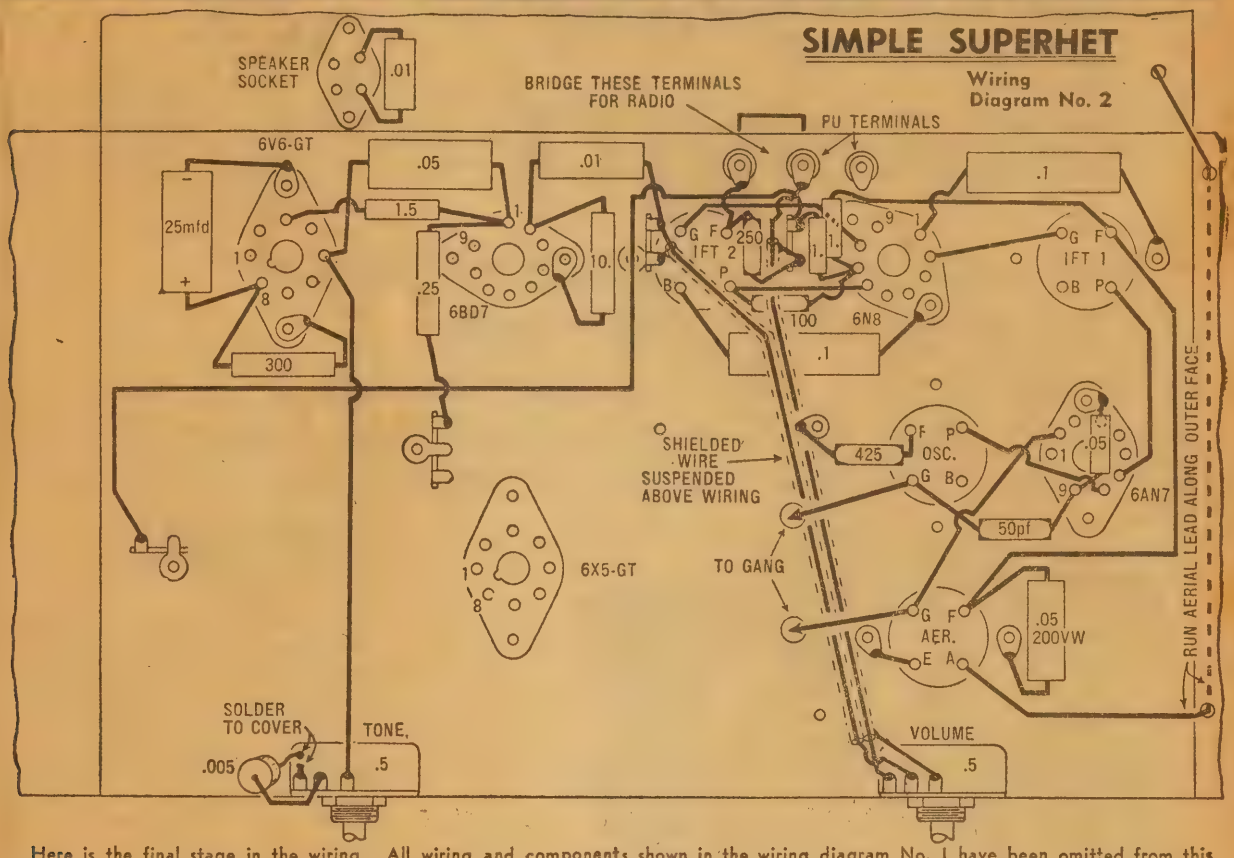
THE FINAL STAGE OF THE UNDER-CHASSIS WIRING



Here is the final stage in the wiring. All wiring and components shown in the wiring diagram No. 1 have been omitted from this diagram for the sake of clarity. When completed do not forget to place a wire bridge across the top of the two terminals marked. To use a pickup, remove the bridge from one terminal.

Note that the shielded wiring is suspended clear of the other wiring in its run from the control to the other side of the chassis. The two braids can be held together with a spot of solder at a couple of places along the run.

The third lug of the volume control is connected to the shield braid and thus earthed to the chassis near IFT2. Do not connect the braid to the earthed cover of the volume control.

The lead from the tone control to the grid of the 6V6GT need not be shielded. One outside lug of the tone control and the associated .005 mfd capacitor is soldered to the cover of the control, which is automatically earthed when the control is mounted.

RESISTOR WATTAGE

We have used the ½-watt size of resistors where applicable. They can be replaced by 1-watt size if you have them on hand, but not vice versa. The 10 megohm resistor at the grid of the 6BD7 is shown in the photograph and diagram as a 1-watt size but mentioned in the parts list as a ½-watt size. The size here is optional, there being plenty of room for the 1-watt size.

The lead to the aerial is taken out through a hole in the side of the chassis near the aerial coil, then in and out again near the corner. This is to keep it away from the IF wiring.

The gang section trimming capacitors are usually mounted across the top of each section of the gang as a matter of convenience. These are shown in the rear photograph. See that the top plate is the one which connects to the frame of the tuning gang.

To fit the dial, remove the screw holding the drum drive to the dial backplate, and, as you move the dial into position, slip the drum drive over the spindle of the tuning gang. With the dial fastened to the chassis, tighten the grub screws on to the gang shaft so that there is equal overlap of the dial pointer on the dial as the drum drive moves the gang plates from one extreme to the other. Incidentally, the dial glass should suit the gang. Ask your dealer about this.

With the valves in position and an aerial connected, switch the set on and watch for any blue glow in the rectifier. A blue glow indicates a heavy overload on the rectifier, caused by incorrect wiring or a breakdown and should be cleared without further ado.

See that there is a bridge across the

PARTS LIST

1 Chassis 10⅝ x 6¾ x 2¾in.
1 Power transformer 225V a side 50 mA, 6.3V 2A (PF201 or similar).
1 60 mA filter choke.
1 2-section miniature gang tuning capacitor (AWA).
2 Gang section trimming capacitors.
1 dial with glass to suit gang (USL32 or similar).
1 Broadcast aerial coil, 1 broadcast oscillator coil.
2 IF transformers, 455 Kc, Nos. 1 and 2.
2 Octal sockets, 3 9-pin miniature sockets, 1 4-pin miniature socket and plug.

VALVES

1 6AN7, 1 6N8, 1 6BD7, 1 6V6GT, 1 6X5GT.

CAPACITORS

1 25 mfd 40PV electrolytic, 2 16 mfd 525PV electro., 1 8 mfd 525PV electro.
2 .1mfd 350 or 400WV, 1 .05 mfd 350 or 400WV, 1 .05 mfd 200 or 350 WV.
2 .01 mfd tubular, 1 .005 tubular, 1 425 pf low tolerance mica, 1 250 pf, 1 100 pf, 1 50 pf.

RESISTORS

1 10 meg ½w, 1 1.5 meg ½w, 2 1 meg ½w, 2 .5 meg potentiometers, 1 .25 meg 1w, 2 .05 meg 1w, 1.05 meg ½w, 1 .02 meg ½w, 1 300 ohm 1w, 1 50 ohm ½w.

SUNDRIES

3 Terminals (2 red, 1 black), 3 knobs, 2 3-tag and 3 2-tag mounting strips power flex and 3-pin plug, 1 ft shielded hookup wire, 1 or 2 dial lamps 6V .15A, hookup wire, spaghetti, nuts, bolts, solder lugs, solder.

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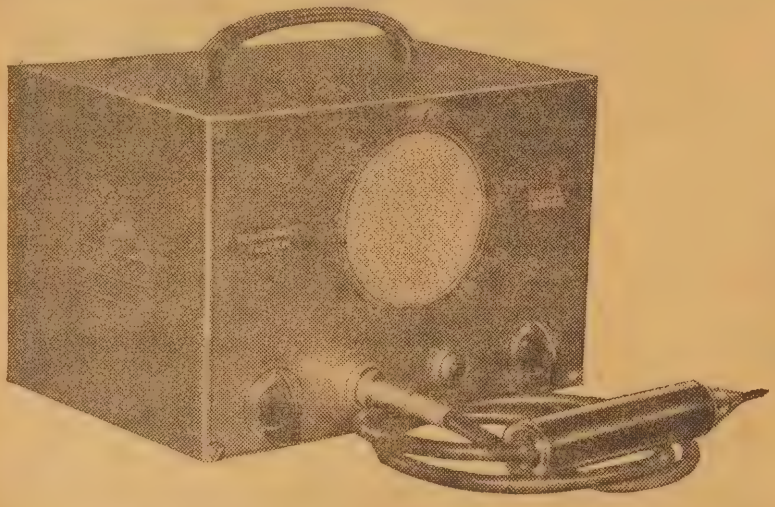

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PROBE FOR SIGNAL TRACER 19/6

appropriate terminals at the rear and tune for and identify a station near the low frequency end of the dial. Adjust the slug in the oscillator coil until this station is tuned in at its correct marking on the dial. Adjust the slug in the aerial coil for loudest volume from this station.

Tune in a station near the high frequency end of the dial and adjust the trimmer across the oscillator section of the gang until it is tuned at its correct spot on the dial. Adjust the aerial section trimmer for loudest volume from this station.

IF ALIGNMENT

If the set seems to tune broadly, it would be best to align the IF transformers at this stage. To do this, select any station, preferably a weak one, and adjust the slugs in both top and bottom of each IF transformer for loudest volume from the station. Go over this adjustment twice.

The final step is to recheck the alignment with the dial markings, going over that twice, just to make sure. The "golden rule" of this part of the business is to adjust coil slugs only at the low frequency end and trimmers only at the high frequency end.

When you are satisfied with the adjustments of the trimmers and the coil and IF transformer slugs, seal them in position so that they will not be detuned by vibration during the subsequent life of the set.

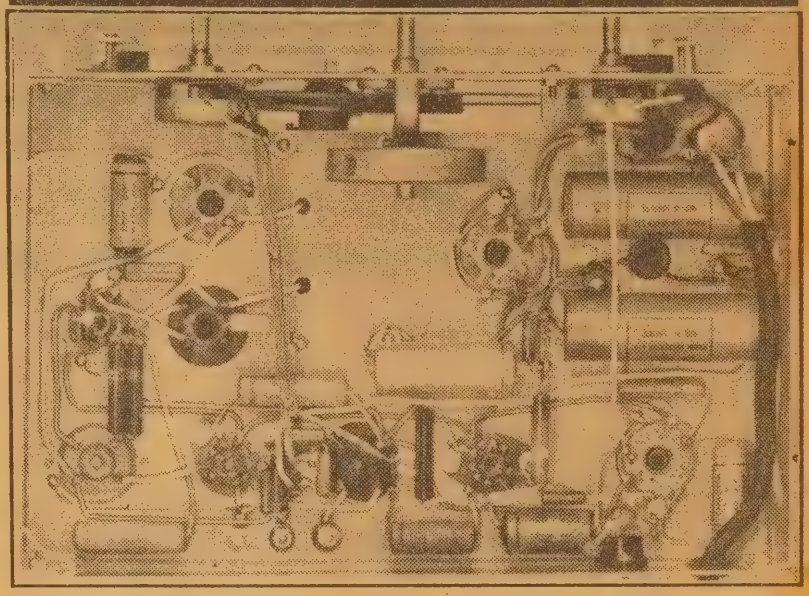
On the matter of a speaker, you will need a permagnetic type, with a transformer attached to match the voice coil impedance to the optimum load requirement of 5000 ohms for the 6V6GT. A 7in or 8in speaker will give good results, but a 12in speaker is the best choice if the cabinet will accommodate it.

Two leads will come from the speaker transformer and connect to the set via two pins of the four-pin plug and socket at the rear face of the chassis.

Sometimes a third wire is run from the speaker frame through the plug and socket to the nearest solder

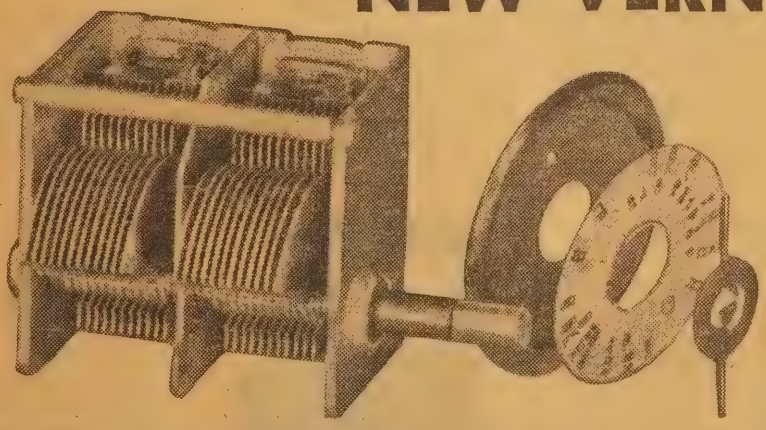
(Continued on Page 96)

UNDERNEATH VIEW OF CHASSIS



The finished wiring job should look neat and orderly with everything firmly in position. Cut every lead to the right length and avoid having slack lengths of wire, which make for an untidy, sloppy job.

THE "ROBLAN" NEW VERNIER DRIVE



Standard and vernier Roblan gang condensers are now available with maximum capacity values of either 370 or 415 mmfd. (The latter tracks with "H-type" dials). All gangs are supplied complete with mounting feet.

370 mmfd gang has 12 rotor plates and the 415, 13 rotor plates. The new vernier drive is supplied as a complete tuning set including metal escutcheon, calibrated celluloid dial and pointer.

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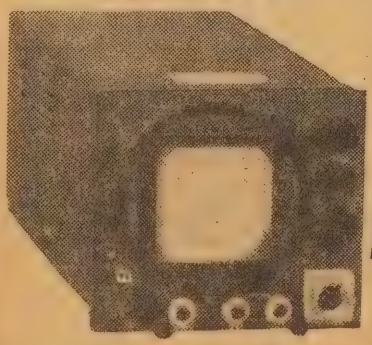

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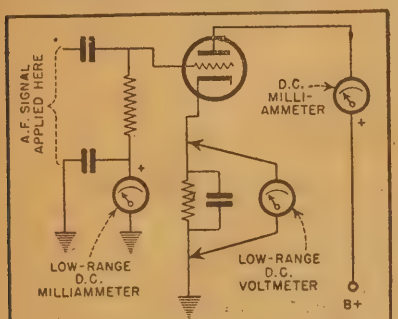
MEASURING AMPLIFIER DISTORTION

The value of an audio amplifier is largely governed by the amount of harmonic distortion which the amplifier introduces into the signal. This paper by Aerovox Engineers, outlines various methods by which distortion is commonly measured in laboratories.

THE simplest qualitative test for distortion in a Class A audio-single ended stage may be made, as shown in Figure 1, by applying a signal voltage of proper level to the input and inspecting the circuit for one



—SIMPLE AMPLIFIER STAGE WITH METERS FOR DETECTING DISTORTION—

Fig. 1

or all of the following abnormal conditions:

(a) Presence of dc grid current,
(b) Fluctuation of the dc plate current.
(c) Fluctuation of the dc cathode voltage, if the circuit employs cathode resistor bias.

Each of these indications generally occurs in a positive direction, and each will disappear upon removal of the signal.

It must be borne in mind, however, that this method is purely rudimentary in nature and serves only to detect the presence of distortion.

The three simple indications are well known, and frequently used by servicemen and PA testers who have no equipment suitable for making quantitative distortion measurements, but must, in the course of routine testing, localise distortion without reference to the actual per cent harmonic energy present.

AVERAGE VALUE

The cathode circuit effects noted above are due to fluctuations in the voltage drop across the cathode resistor, occasioned by variations in the dc component of plate current.

The current indicated by the plate-circuit milliammeter is the average value of the fluctuating "signal" plate current, is identical with the dc component, and is the current that produces the cathode resistor drop.

These facts may be better comprehended when it is remembered that the fluctuating signal plate current (Figure 2) is an alternating current corresponding to the signal, superimposed upon a direct current.

It will be evident from the fundamental relations of this combination that the average value of plate current, as indicated by the plate-circuit milliammeter, will be constant under distortionless operating conditions.

Figure 2 is a graphical representation of signal plate current. I max is the maximum value reached by the fluctuating plate current; Io, the zero-signal value; I min the minimum value.

From these values, it may be shown that the per cent second-harmonic content (often the most troublesome distortion factor) is equal to:

$$\frac{\frac{1}{2}\left(I_{max.} + I_{min.}\right) - I_o}{I_{max.} - I_{min.}} \times 100$$

Quantitative methods of checking distortion are harmonic analyses, and are concerned with measurement of the actual amount of energy present in each separate harmonic of the signal frequency (or in the total harmonic content) and establishment of percentages with respect to the fundamental frequency.

The most representative methods employed in wave analysis and the apparatus necessary thereto will be described presently.

The cathode ray oscilloscope is notably useful in the observation of wave shapes.

When the horizontal plates of the ray tube are energised by a linear time base, and the signal is applied to the vertical plates, the cathode ray trace will be an exact reproduction of the wave form of the applied signal voltage.

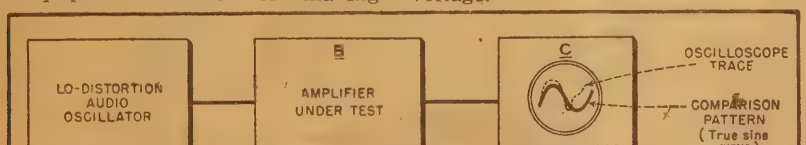


Fig. 3

An audio-frequency amplifier may be checked for distortion with the oscilloscope in the manner illustrated in Figure 3.

A is an audio oscillator possessing an output voltage wave form of known purity, B is the amplifier under test, and C is an oscilloscope.

The units are connected in the order shown.

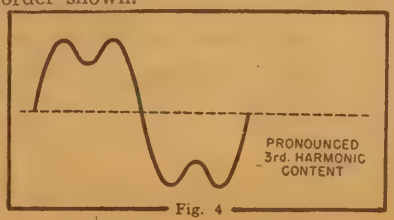


Fig. 4

It is the purpose of the oscillator to supply a signal of as pure wave form as practicable to the amplifier, and that of the oscilloscope to reproduce the wave shape of the signal after it has passed through the amplifier.

In order that as little distortion as possible be introduced by the instruments themselves, the oscillator used for such a test must be of exceptionally high quality, and the amplifiers in the oscilloscope must possess ex-

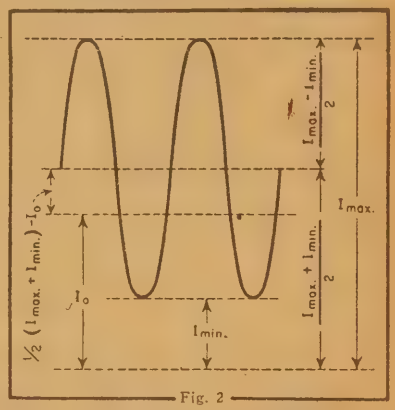


Fig. 2

cellent characteristics. Likewise, the oscilloscope sweep circuit must be uncompromisingly linear in its characteristic.

If the amplifier had no distortion at all, the signal it delivered to the oscilloscope would be an exact reproduction of the input signal wave form. This is never encountered in practice, however, the most efficient amplified arrangement being beset with the distortion characteristics of its tubes and other components.

For observations, a perfect sine wave (or, better still, a tracing of a single cycle from the test oscillator) might be inscribed on the transparent viewing screen of the oscilloscope, and signals from the amplifier matched to this pattern to discover variations from the original shape due to amplified distortion.

In making such a test, it would of course be necessary to adjust both oscilloscope amplifier gain controls in such manner that the maximum amplitude and width of the signal trace coincided with those dimensions of the inscribed pattern.

PRINTED SCREEN

With the low percentages encountered with most well-designed amplifying equipment, it will be difficult to estimate the percentage of harmonic content from the reproduced wave shape, in the oscilloscope method unless the operator makes use of the transparent screens furnished by some oscilloscope manufacturers for the purpose.

These screens carry printed patterns of single cycles corresponding to the shapes obtained (variations

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1332-3H	200-220-230-240	300	120	2 x 6.3v-2A; 5v-3A	53/3
1356-3H	200-220-230-240	400	150	5v-3A; 2.5v-5A; 6.3v-4A	70/-
1380-3H	200-220-230-240	450	200	2 x 6.3v-2A; 5v-3A	102/6
1371-8	200-220-230-240	500-600-750-850-1000	300		150/-
1400-19	200-220-230-240	565-500-425	250	2 x 6.3v-3A; 2 x 2.5v-3A, 5v-3A	110/-
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1305-22	200-220-230-240	—	—	2.5v-10A (3000v insul)	75/-

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967-1A	35	20	150	200	1000	46/-
956-1A	30	20	200	160	1000	57/9
1011-1A	30	15	250	160	1000	59/6
*983-1A	25	20/5	30/300	90	1000	65/6
936-1A	15	10	300	60	1000	62/6

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894-23	500	2, 3.7, 8, 12.5	2	50-10,000	5	LINE TO VOICE COIL	26/3
700-22	2500, 5000	2, 3.7, 8, 12.5, 15	1	*40-15,000	15	SINGLE 807, EL34 ETC, TO VC	57/6
896-9	8000, 10,000	2, 3.7, 8, 12.5, 15	1	30-15,000	15	PP 6V6G's A OR AB1 TO VC	62/6
897-9	8000, 10,000	100, 125, 166, 250, 500	1	30-15,000	15	PP 6V6G's A OR AB1 TO LINE	62/6
763-9	3000, 5000	2, 3.7, 8, 12.5, 15	1	40-20,000	15	PP 2A3's A OR AB1 TO VC	62/6
809-26	500	2, 3.7, 8, 12.5, 15	1	50-20,000	15	LINE TO VOICE COIL	42/6
870-26	10,000	2 or 8	1	*20-20,000	6**	PP 6V6G's OR 807's AS TRIODES	57/6
871-9	10,000	2 or 8	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
872-9	10,000	3.7 or 15	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
891-22	6600	83, 100, 125, 166, 250, 500	1	50-12,000	35	PP 807's AB1 TO LINE	82/6
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INPUT TO GRID TRANSFORMERS

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502-10	600-100,000 OHMS	MUMETAL CORE	30-10,000 CPS	65/-
563-6	600-60,000 OHMS	STALLOY CORE	200-5000 CPS	42/6

INTERSTAGE TRANSFORMERS

518-6	20,000 TO 20,000 OHMS	SE OR PP	RADIOMETAL CORE	1:1 RATIO 30-10,000 CPS	69/-
519-6	20,000 TO 80,000 OHMS	SE OR PP	RADIOMETAL CORE	1:2 RATIO 30-10,000 CPS	69/-
620-6	20,000 TO 180,000 OHMS	SINGLE ENDED	RADIOMETAL CORE	1:3 RATIO 30-10,000 CPS	69/-

DRIVER TRANSFORMERS

545-9	SE 4000 TO PP AB2 GRIDS 1.6:1. PRIM. TO ½ SEC. RATIO 50-10,000 CPS 5 WATTS	57/6
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710-6	SE OR PP 20,000-600 OHMS	RADIOMETAL CORE. MAX. LEVEL 250 MW. 30-10,000CPS	69/-
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150 mA. D.C. per side on Primary. 150 mA. D.C. Maximum Secondary Current.
Freq. Response: 200-7,000 c.p.s. 75 Watts Rating £9/10/-.

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H—3H: Horizontal mount with steel louvred cover. Sub-terminal panel.
— 8: Open steel clamps. Terminal strip prim. & sec.
—19: Horizontal 6" x 5" cast cover. Sub-terminal panel.
26—23: Open steel brackets. Terminal strips.
6—10— 9: Diecast case with solder terminals.
—21: Open steel clamps. Terminal strips.
—22: Open steel clamps. Terminal strips.
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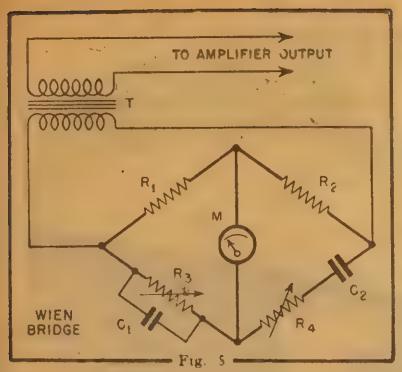

Fig. 5

from true sinusoidal) with various low percentages of distortion.

Severe cases would result in images similar to figure 4 which is an exaggerated representation of pronounced harmonic content.

Certain bridge circuits, notably the Wein bridge (see figure 5) can be used for the identification of frequencies in the audio-frequency spectrum.

If an alternating voltage is delivered to the bridge circuit, the latter may be adjusted for a null at that particular signal frequency. The null point would not hold for the same voltage of another frequency. Thus, the adjustable element of the bridge might be calibrated to read directly in cycles per second.

The Wein bridge is the most useful form for this purpose would have its consonants so chosen that the ratio arm R2 is twice the ohmic value of R1, the condensers C1 and C2 are equal in capacitance, and the two simultaneously adjustable resistance legs R3 and R4 are at all positions equal.

Under these conditions, the frequency or the impressed voltage at null would be equal to:

$$\frac{1}{2\pi RC}$$

Where

Frequency is in cycles per second,
R is the resistance of R_3 or R_4 in ohms,
C is the capacitance of C_1 or C_2 in farads.

Since the bridge may be balanced for only one frequency at a time, it would appear that any residual voltage indicated by the vacuum-tube volt-meter M at null would be due to some other frequency or frequencies (such as harmonics of the fundamental). And this harmonic voltage would be due to the total of harmonic voltages present.

As such, the bridge might be connected, as shown in figure 5, to the output circuit of an audio-frequency amplifier which is passing a signal from a high-quality audio oscillator.

ANOTHER TYPE

While the device might be used as shown as such a harmonic totaliser, the percentage total harmonic content with respect to the readings of the meter before and after null would not be reliable nor would its error be uniform for all frequencies.

These facts are due to the peculiar nature of the bridge to attenuate various harmonics unequally.

Another popular type of bridge harmonic totaliser is shown in figure 6. Here, three legs of the bridge, R2, R3 and R4, contain pure resistance, while the fourth leg contains the shielded parallel resonant circuit LC which is resonant at the test frequency.

The transformer, T, like the one shown in the bridge previously described, must have an excellent frequency characteristic.

At resonant frequency of LC, the inductive reactance of the tuned circuit equals the capacitive reactance, the former is cancelled by the latter, and the bridge balances as if all four legs were pure resistance.

Any voltage applied by the circuit to the vacuum-tube voltmeter is then due to harmonics of the test frequency (and it is assumed that these harmonics have been delivered to the bridge by the amplifier under measurement).

In operation, the double-pole, double-throw switch S is thrown to position 2 and the bridge balanced with the assistance of the vacuum-tube voltmeter M as a null indicator. The reading at null (due to harmonics) is recorded. The switch is then thrown to position I and R5 is adjusted until the meter gives the same reading (as before at null). The following calculation may be performed to determine the percent of total harmonics from this operation:

$$\% H = \frac{R_5}{R_4 + R_5} \times 100$$

or:

A dial indicator attached to the potentiometer R5 may be calibrated directly in these percentages.

FILTER-METER

A very efficient method of measuring total harmonic content in the signal delivered by an audio-frequency amplifier makes use of the arrangement employed in the distortion and noise meters found in broadcast stations. (See Figure 7.)

In this arrangement, the signal from a high-quality sine-wave audio test oscillator is fed into the amplifier under test. The amplifier output is connected to a high-pass filter which removes the test frequency but leaves all of its harmonics.

The actual voltage due to the harmonics is then measured by means of an attenuator and vacuum-tube output voltmeter.

This measurement is one of total harmonic distortion, but it is entirely possible to arrange additional flat-response amplification with various high-pass filters to remove the various harmonics singly along with the fundamental.

The wave analyser, a highly-developed and refined form of hetero-

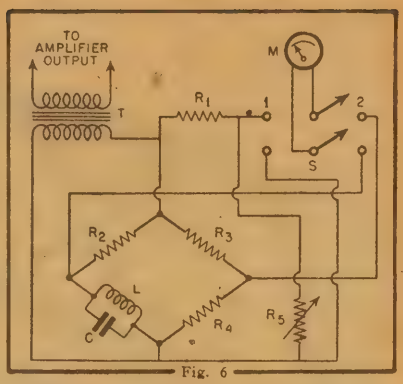

Fig. 6

dyne vacuum-tube voltmeter, provides the most advanced, accurate, and complete means of measuring amplifier distortion by determining the various harmonic voltage magnitudes.

The instrument is tunable to the fundamental and any of a series of its harmonics separately, so that wave forms of considerable complexity may be investigated. At the same time, measurements of hum and noise amplitude are made available.

In effect it is a highly selective electronic voltmeter.

The representative wave analyser (General Radio) receives the signal to be inspected through an input channel embracing an input multiplier, amplifier, and pad (see the functional block diagram of Figure 8).

The frequencies accepted by the input channel lie in the range 20 to 16,000 cycles per second—the entire common audio frequency spectrum.

A local heterodyne oscillator stage supplies heterodyning voltage of such frequency variation that throughout the signal input range, an intermediate frequency of 50 kc. may be produced. The dial controlling this oscillator is graduated in the frequencies admitted by the input channel.

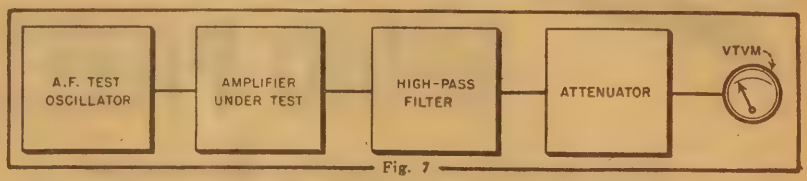

Fig. 7

The fixed-frequency 50 kc. i.f. channel is extremely sharp, containing three quartz crystals and is preceded by a balanced modulator, the output of which contains the upper and lower sidebands obtained from the heterodyning process.

The carrier is suppressed. The superselective i.f. channel is followed by a 50 kc. amplifier and the indicating instrument.

In operation the wave analyser is tuned to the fundamental test frequency and then to the successive harmonics to an extent determined by the amount of frequency tuning range between the fundamental and the 16 kc. limit of the dial. The harmonic amplitudes are indicated directly by the meter.

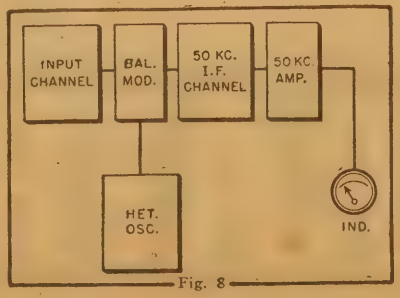

Fig. 8

WHEN wiring in a tubular bypass capacitor, it is usually wise to connect the outside foil to the chassis. This particular pigtail connection is identified with a small moulded "blob" or an "O" near that end of the capacitor.

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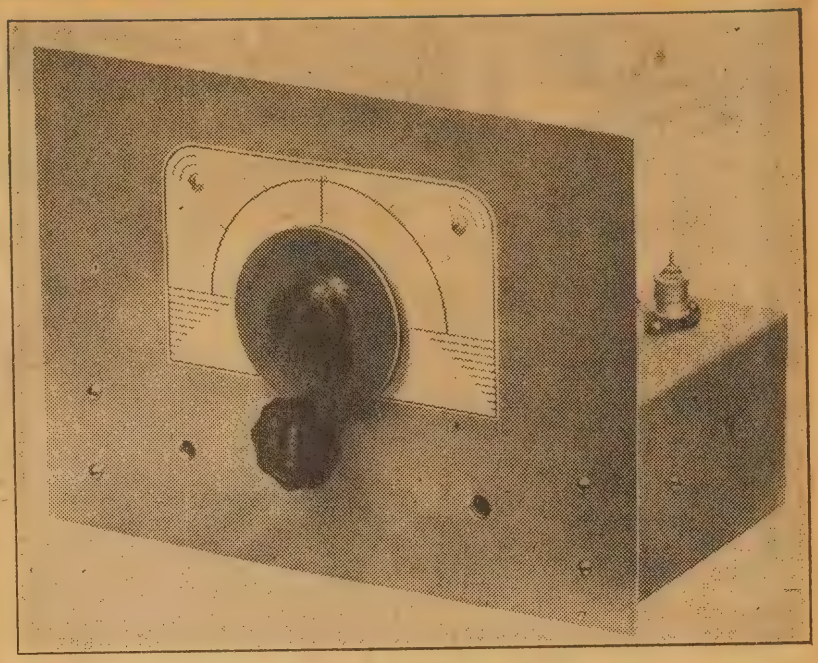


The converter is built on a panel and chassis which fit into our standard instrument case. Any smooth acting dial can be used—this one cost very little on a disposals table. Note holes for hand trimmers if used.

A STANDARD 50Mc. CONVERTER

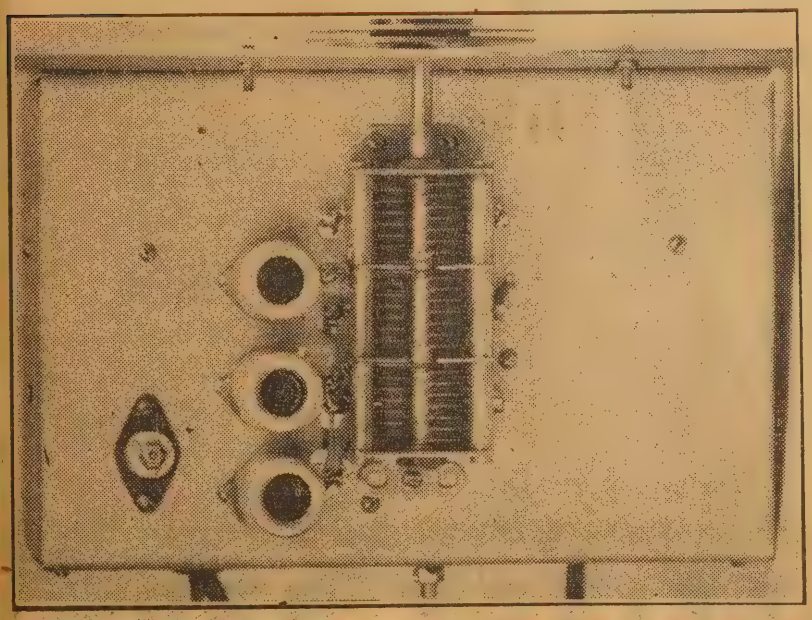
Anyone can build this high performance 50 Mc converter and we hope it may assist many amateurs and listeners to operate on VHF. It feeds into any good SW receiver at 7.3 Mc and is described here in full detail.

LAST month's VHF article discussed a number of problems associated with reception on the VHF bands, together with typical circuits used for this purpose.

This month we describe the first of these converters in more detail, paying particular attention to the more important matters of layout, which, unless properly understood, will prevent the best results from being obtained.

There is nothing at all complex about the circuit. It is just as simple as those used on the broadcast band, or the ordinary shortwave bands. The secret of complete success lies more in placing the right components in the right place than in any mysterious "know-how."

The 50 Mc converter is to be treated first because it breaks the least unfamiliar ground. Once the builder has become used to working with very short leads and tiny coils, he is likely to have more success on 144 Mc, where general circuitry begins to change and more attention must be paid to numerous details.



Above the chassis. Valves top to bottom are, 6AK5, 6AG5 and 6C4. The 3-30 trimmer tunes the coupling coil. Connections from the gang are taken through chassis holes to the coils underneath. There is room for a small power supply should this be needed—it certainly makes the converter more flexible.

The present intention is to describe a 144 Mc converter in addition to this one, and perhaps a third unit, which will serve as the IF and audio channel for both. If these three units are built on similar-sized chassis, they will together make a handy and extremely efficient receiving combination for the popular VHF bands.

Various other converters for these or additional bands could be made to switch through this common IF and audio channel, which, of course, can be fitted with AVC, noise limiting, and so on, thus avoiding duplication as would be necessary if each tuner had its own "back end."

USE OF CONVERTERS

Most experimenters use converters today because a suitable IF to follow the converter or mixer valve lies in the region of about 5-10 Mc. Any communications type of set already tunes over this range, so that if we select a spot frequency as the IF for our converter, we can simply connect its output to the set's aerial input, and tune the set to this frequency. As long as we pick a spot clear of a shortwave station strong enough to ride through

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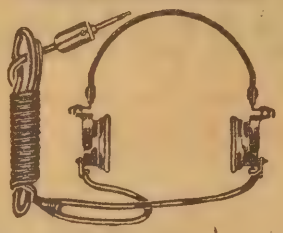

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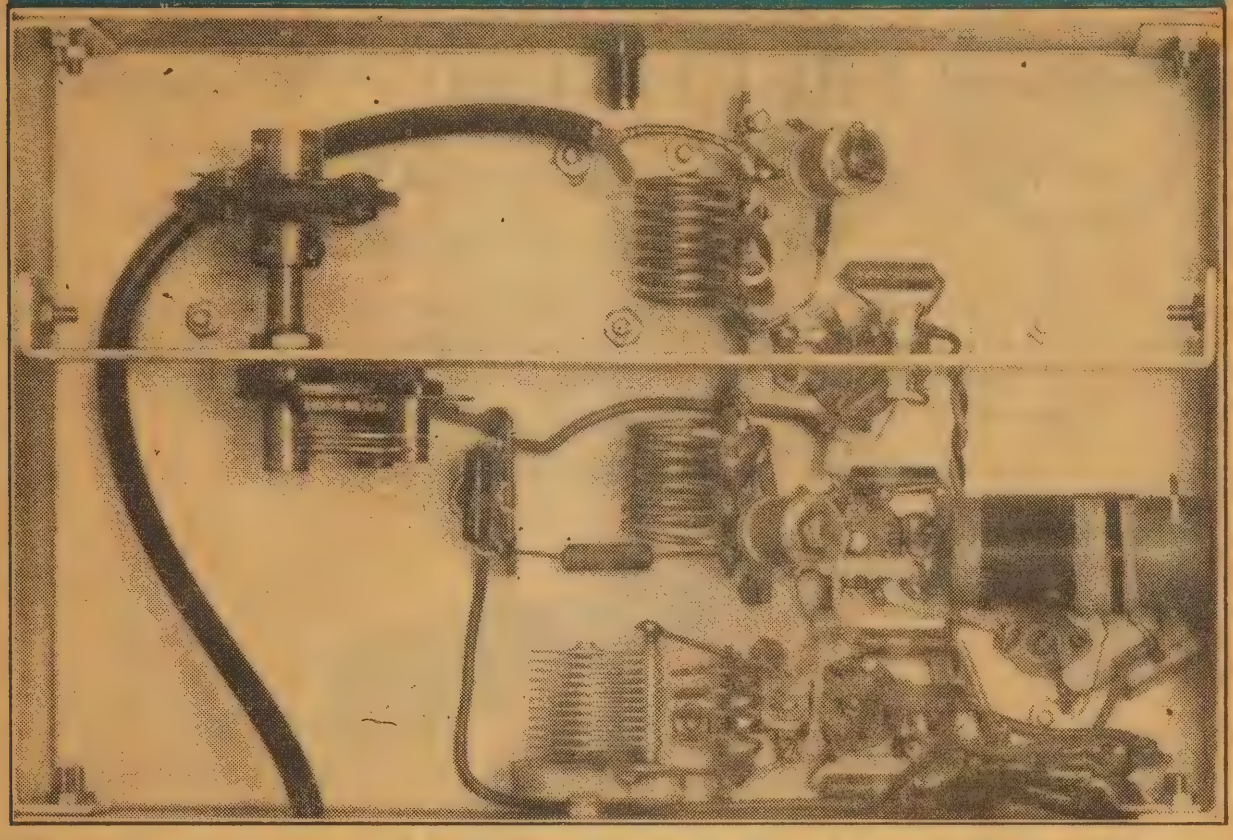
UNDER-CHASSIS OF THE 50mc CONVERTER



This picture clearly shows placement of all major components. The mixer band trimmer is included to show where it would be placed if used. The RF trimmer would balance it at the right hand side. The chassis measures 8in x 5¼in x 2¼in and the panel 9¼in x 6¾in. It is intended to fit our standard instrument case.

—and this is quite easy—the idea works splendidly. If the shortwave set has a BFO, noise limiter, &c., these are just as useable with the converter as they were originally.

The connection and vice-versa of the converter could be arranged by simple switching, so that even the inconvenience of making the change by hand can be removed. In addition, many shortwave sets have enough power supply reserve to stand the extra drain of a converter, whose power connections can be plugged into a socket mounted on the set. These include a 6.3v at .65a, and 250v. at 25ma.

In selecting a suitable IF there should be a fairly wide separation between the signal and oscillator frequencies. The main reason for this is to avoid double-spotting on the VHF band. Both bands concerned are 4 Mcs wide, and as the image or spot always occurs twice the IF from the signal itself, it follows that an IF of at least 2 Mc is needed for this 4 Mc bandwidth.

SELECTED FREQUENCY

This frequency is OK for 50 Mc, but to minimise oscillator pulling, &c., particularly at 144 Mc, an even higher frequency is generally used. One of 10.6 Mc is standard, but isn't much help to the many amateurs, whose receivers cover only the amateur bands.

We have therefore used a frequency of 7.3 Mc, just clear of the 7 Mc amateur band, a spot which will be available on almost any shortwave set. The exact frequency doesn't matter, as long as the converter output coil and the receiver proper are both tuned to it.

Experiments with both 50 and 144 Mc show that this is a suitable IF for both bands.

The entire system is really a double superheterodyne in which the tuner converts first to 7.3 Mc and then to 465 kc, assuming this to be the IF of the receiver. The first conversion allows us to avoid images or double-spots, and the second gives us the same order of selectivity as that possessed normally by the set.

This converter is particularly stable, and, therefore, shows little if any oscillator drift even with an extremely sharp receiver. As a rule, however, the normal selectivity of one or two IF stages at 465kc is adequate for the purpose.

The set we have been using is able to lose any station within about 5 Kc at 7 Mc, but despite this selectivity, the converter can be handled and even bumped on the table without seriously detuning 50 Mc stations. After a few minutes, the effect of oscillator drift is negligible over a period of time.

There are many variations of valves and valve arrangements which are satisfactory for a 50 Mc converter. Only one circuit can be used at a time, and we have elected to use a pentode in both RF and mixer sections to give high gain and reasonable noise level, together with a separate oscillator valve using a triode.

The 6AK5 is probably the best RF amplifier and has been used for this reason. It is harder to stabilise than some other types unless layout and shielding are carefully arranged. For this reason we have taken a good deal of trouble to present the exact layout and shielding used in the original, which was quite stable even without the aerial connected.

OTHER TYPES

Other valves will work almost as well in this socket. The 6AG5 is perhaps the next choice, and the 6BA6 is also good. Some new valves now being released should also behave well, such as the 6AM6 and the EF80. A 9003 will do, and should not be overlooked just because it is not the equal in performance of the "super" types.

When valves other than those specified are used, check carefully on socket connections which may be slightly different. Plate and screen voltages should be obtained by using appropriate dropping resistors. The 6AK5 is limited in permissible plate voltage, and should not normally use more than 150 volts.

The mixer is a 6AG5. We like it for its combination of high gain

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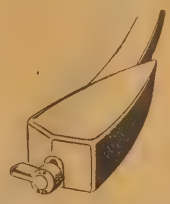

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and stability. Once again, all the valves previously mentioned will operate well as converters, with appropriate attention to socket connections and voltages.

The main point in choosing the oscillator is stability, which is probably affected most by temperature changes. For this reason the 9002 is perhaps the best choice, as its elements are very small and normalise quickly. The 6C4 is nearly as good, and a more robust valve. There seems little advantage in using a pentode in an electron coupled circuit, as the necessary coupling between 50 and 51 Mc the amount of adsmall.

THE TUNING COILS

On this band, the EF50, RL7, RL16 types are quite practicable, but we prefer the miniature valves because they allow such a compact layout. If you are able to do so, the general arrangement shown here can be scaled up to use them. The RL7 would be the RF valve, an EF50 the mixer, and the RL16 the oscillator.

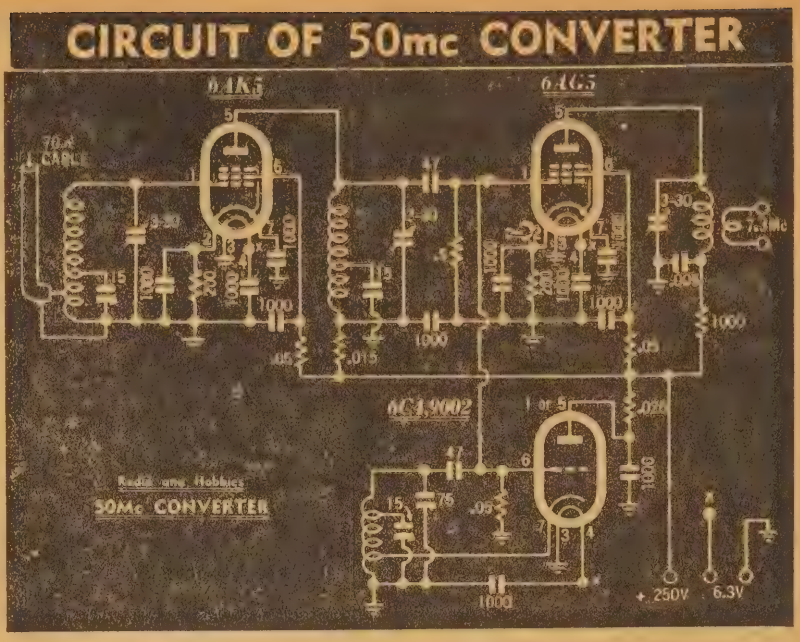
The three tuning coils are supported under the chassis near the valve sockets on small terminal strips as normally used for mounting components. There is really no need to worry over better insulation unless you are fussy. Each is tuned to the band by trimmers. The RF and mixed circuits use 3-30 air-spaced types, and the oscillator a midget variable with a maximum of 75 mmfds. Such condensers were used freely in disposals equipment, and can be obtained new for a few shillings.

One thing is essential, namely that the condenser be mechanically precise in its action. Any slop in the bearing will make tuning a hopeless proposition, particularly if the condenser is only a single bearing type.

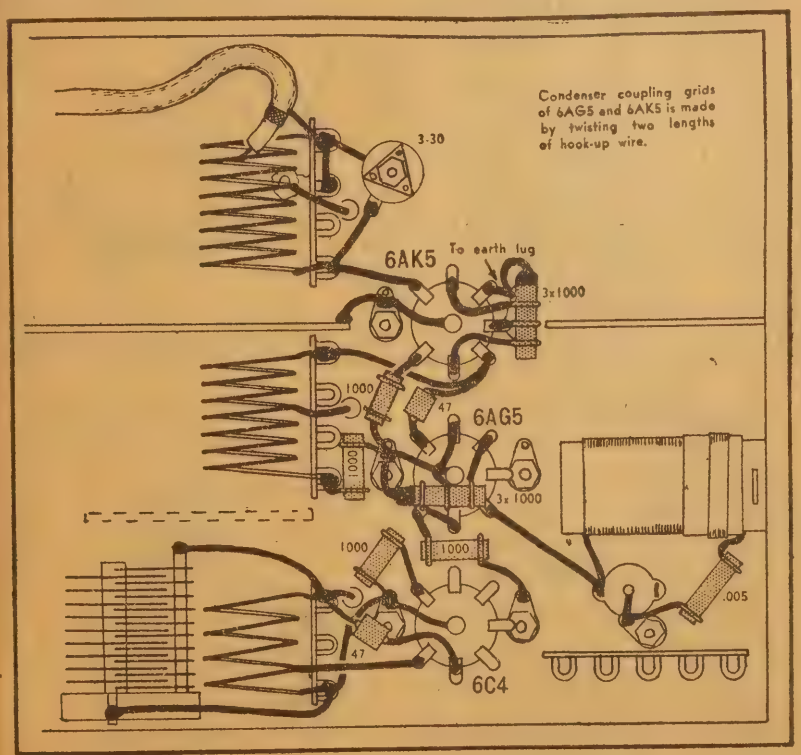
Care should be taken also to avoid mounting stresses which will magnify any possible effects from chassis movement.

The tuning in our case is done by a small 3-gang ex-disposals condenser of about 15 pf capacitance per section. There are quite a few such condensers about and they are ideal.

It would be possible to use three small single condensers joined with flexible couplers. In this case it would be highly desirable to mount the front panel on what is now the rear of the chassis so as to bring the oscillator gang section immediately behind the dial. With a series of couplers a certain amount of weaving is hard to avoid, and this would introduce backlash into the tuning.



Note double earthing of 6AK5 and 6AG5 cathodes. Bypassing the "hot" filament lugs is wise but not essential. This circuit in general will suit various valve combinations.



This skeleton layout diagram shows the essential bypass connections using "stick" condensers, and tiny, "button" couplers. The mixer trimmer has been omitted for clarity together with non-critical wiring. Drawing is to scale.

HAND TRIMMERS

Another possibility would be to use an extended shaft to tune a single oscillator condenser and hand-operated trimmers to keep the RF and mixer circuits in line. This isn't as awkward as it seems because the aerial circuit tunes rather broadly, and as most stations are heard between 50 and 51 Mc the amount of adjustment required to the mixer trimmer is quite small — not even important for local stations. These hand-operated trimmers can take the place of the present pre-set types across the first two coils.

The RF coil trimmer would mount on the front edge of the chassis near its coil. The mixer trimmer would be mounted on the shield extension as shown in the photograph. If any difficulty is experienced in getting the gang to track, these hand trimmers are quite useful in any event. They can be tapped down the coils as the alternative to being connected right across them, according to their actual capacitance, which should be between 15 and 25 pf.

In our job the gang tracked perfectly over the full band by wiring the oscillator section right across its coil and by tapping the other two sections three turns from the grounded ends. It isn't hard to get good tracking by opening out or closing up the turns on the ground side of the tap to reduce or increase slightly the amount of spread. The exact position of the taps can easily be moved half a turn either way, and we have made the coils quite accessible for this purpose. The leads to

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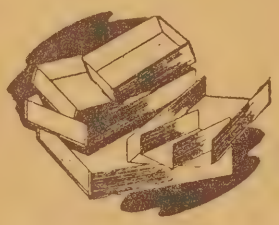
RC5—Standard High Gain R.F. Coil	12/11
RC6—Mini. Reinartz Coil	14/6
RC8—Standard Reinartz Coil	12/11
O1—Mini. I.R.5 type wound on resistor	6/9
O2—Mini. Osc. Coil for IR5, 6J8, etc.	12/11
O4—Mini. Coil for ECH33, 34, 35, X61M, 6AN7, 6AE8	12/11
O5—Mini. Osc. Coil for 6BE6, 6SA7	12/11
OME—Magnetic Tape Recorder bias coil	18/4
IC1—Ignition Hash Coil for Car Radios	1/7
RC9—Untuned R.F. Coil or 16M.H. R.F. Choke	4/-
K1—Knobs, flush, walnut, black-ivory	1/3
IF12/13—Miniature 1600 Kc IF's	19/4
IF2/3—Standard High Gain 455 Kc IF's	19/4
IF10/11—Standard High Gain Batt. Type IF's 455 Kc's	17/5
IF14/15—Standard Gen. Purp. 1900 Kc IF's	19/4
IF1/2—Miniature 455 Kc IF's	19/4
DW4—Midget single stage unit B/C and 16-50M suit 6J8, 6A8 converters	72/6
DW5—Midget single stage unit B/C and 16-50M suit ECH33, 34, 35, X61M, 6AN7, 6AE8 converters	72/6
DW6—Midget single stage unit B/C and 16-50M suit IR5 converter	72/6
DW7—Midget single stage unit B/C and 16-50M suit 6BE6, 6SA7	72/6
DWR4—Midget R.F. stage unit as for DW4	135/4
DWR5—Midget R.F. stage unit as for DW4 also B/C and 13-42M	135/4
DWR6—Midget R.F. stage unit as for DW6	135/4
DWR7—Midget R.F. stage unit as for DW7	135/4
BP1—Hi Fi Band Pass Coil and IF Kit	85/-
BP2—Midget Version BP1	85/-
CRK1—Car Radio Kit of coils midget	81/2
CRK3—Sen. Car Radio Kit with AC7 Coil	86/-
RFC1—2.5 mH choke 50 mas pig-tail conn.	4/-
RFC2—2.5 mH choke 100 mas 4 pi tapered	6/-
RFC3—2.5 mH choke 100 mas iron cored	4/-
S.W.—Standard Short Wave Coils, all types	6/10
USW—Unwound Formers comp. with core and mounting grooved 16 T.P.I.	4/10

C.D.—Poly. coil dope and sealer, 3/5 jar
WFC1—Whistle Filter Choke 8/9

Subject to Alteration without notice—

REMEMBER "Q" PLUS COILS ARE FULLY GUARANTEED BY THE MAKERS

ALUMINIUM CHASSIS AND PANELS



6 x 4 x 2 open	5/5
12 x 7 x 2 open	9/9
6 x 4 x 2 welded	7/6
8 x 5 x 2½ welded	10/-
10 x 6 x 2¼ welded	12/-
11 x 8 x 2 welded	14/-
13 x 7 x 2¼ welded	14/-
13 x 10 x 2¼ welded	17/6
17 x 8 x 3 welded	22/6
17 x 10 x 3 welded	24/6
17 x 12 x 3 welded	26/6

Chassis made to special sizes approx. 50% more. Post free.

Aluminium panels 18G, cut square

15in x 12in	9/-
18in x 15in	13/6

Other sizes cut to order per square foot 8/-

All above lines are post free at prices quoted.

HARD-TO-GET?

We Have These!

12AT7	32/6	1H4GT	14/6
12A8GT	21/6	1J6GT	14/6
12J7GT	22/6	3S4	18/6
12K7GT	21/6	12SQ7GT	19/-
12Q7GT	19/3	12SL7GT	23/9
12Z3	25/9	12SR7	20/3
12SA7GT	21/-	25A6GT	21/-
12SG7	21/-	25L6GT	20/3
12SK7GT	22/3	25Z6GT	18/3
35Z5	15/9	32L7GT	32/6
35W4	18/-	117Z6GT	23/3

ALL POST FREE

We hold the most varied valve variety in Australia.

CONDENSERS

8/350pv Electro	3/9
10/40pv Electro	3/6
115 mmfd Silver Mica 6 for	7/6
Germanium Diodes	12/6
Copper Cored Steel Aerial Wire 100ft	7/6
50ft	4/-

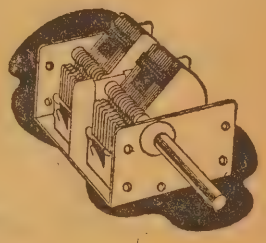
Porcelain Egg Insulators 9d each.

FAST-QUOTE-SERVICE

Write on the left hand side of a sheet of paper the radio parts that interest you—one beneath the other. If a kit, itemise.

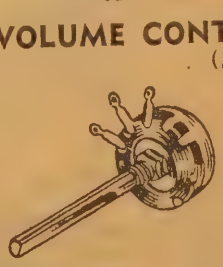
Add your name and address and send it to us with a stamped, self-addressed envelope. We will add the latest prices and return to you same day.

TUNING GANGS



"Jackson" 2-Gang with inbuilt Trimmers	17/6
A.W.A. Standard 2-Gang	29/6
"H" Type 2-Gang	29/6

VOLUME CONTROLS (Midget)



10,000 ohm Bradley	2/6
30,000 ohm Bradley	2/6
½ meg English	3/9
100K Technico	3/6

COLLINS RADIO 409 LONSDALE ST., MELBOURNE, VIC. Phone Orders MU1033

THE FASTEST MAIL ORDER SERVICE IN AUSTRALIA

the gang sections run through holes in the chassis.

The oscillator section needs special mention. It must be as rigid as possible, particularly the coil mounting and all leads to it, including the lead to the tuning gang. This should be of 18 or 16 gauge wire, not hook-up wire.

In the interests of stability a high-C circuit is used, and most of the 75 pf semi-variable will be in mesh when you hit the band. This condenser is mounted on the back edge of the chassis and again connected to the coil by heavy leads. There can be little movement or weaving in the entire tuning assembly if this construction is followed. The condenser is adjusted from behind the chassis and locked to prevent movement.

OUTPUT COIL

The output coupling coil is a simple winding on a cardboard former tuned to 7.3 Mc with a 3-30 trimmer. A layer of brown paper or insulating tape is wrapped around the earthed end and the output winding of a few turns placed over it. When mounted as shown the lead from the mixer plate comes from the top end of the coil.

For convenience the trimmer condenser is mounted above the chassis. There is a blocking condenser at the bottom end of the coil so that the top half of the trimmer isn't "hot." A strip of aluminium or brass runs through slits in the former so that it can be mounted against the side of the chassis by a single bolt.

The RF coil has eight turns tapped at 1½ for aerial connection and three turns for the gang. The mixer coil has seven turns tapped at three for the gang. Both are spaced a little more than one wire diameter, the wire being 16 gauge, and the diameter 5-8th inch (in our case a fraction larger).

The oscillator coil has four turns of the same wire and diameter spaced about ¾-inch. The cathode taps one turn from the earthed end, and the gang is connected across the whole coil.

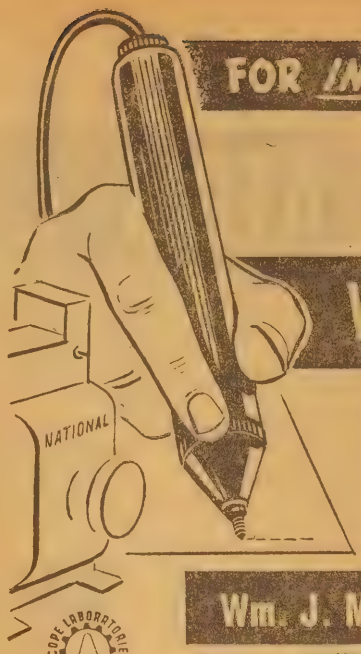
The output coupling coil has 44 turns of 28 enamelled wire close wound on a 5-8 inch former. The output winding has five turns of the same wire wound over the bottom end.

LAYOUT

The importance of layout is such that we have prepared a special diagram showing the socket and screen positions together with the important bypass condensers, &c. It is by no means a complete wiring diagram.

The 6AK5 socket is bisected by a screening partition which places the input grid circuit on one side and the output plate circuit on the other. There is a cathode terminal on each side of the partition and it is thus possible to bypass the cathode to separate earth points for both grid and plate connections. The partition is connected to the centre spigot of the socket where it passes overhead, the spigot also being earthed to the common grid circuit earth point.

The 3 x 100 pf stick condenser shown half-way through the screen aperture bypasses the cathode on the grid side, the screen, and the "hot" side of the filament, this latter being a precautionary measure. If the second cathode terminal is bypassed (and at 50 Mc this is not always



FOR *INDELIBLY* MARKING...

Instrument panels, dials, keys, cutlery, tools, materials, and ALL ferrous and non-ferrous metals of dull or bright finish.

VIBROSCOPE

It is so much easier when you use a vibroscope. The combination of mechanical and electrical etching action makes the VIBROSCOPE unique in performance. Operates from Scope's Iron Transformer, or AC/DC sources between 3 and 4 volts. Try it yourself at your local supplier.

Price 35/-. Fully guaranteed.
Additional Tungsten Tips, 2/3 each.

Australian and Overseas Agents:

Wm. J. McLellan & Co. Pty. Ltd.

126 Sussex Street, Sydney. Phone BX1131.
New Zealand Distributors: H. W. Clarke, Auckland and Wellington.
Manufactured by Scope Laboratories, Melbourne, Victoria.

BRIGHT-STAR CRYSTALS

We make up any crystal in the Amateur frequency. As illustrated, 40 or 80 metres, AT or BT cut. Accuracy 0.02% of your specified frequency.

Priced at .. **£2/12/6**

20 Metre Zero Drift priced at £5 each.
Crystals reground £1 each.

HOME BROADCAST MICOPHONE

Be in the fun at your next party. Particularly suitable for young as well as old. Fits any radio with P.U. terminals attached. Our Price post free. **10/-**

POTENTIOMETERS

We carry full stocks of all leading brands. The following are specials.

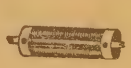
10,000 ohm	3/6
150,000 ohm	2/6
250,000 ohm	5/9

FASTER MAIL ORDER SERVICE

METAL RECTIFIERS

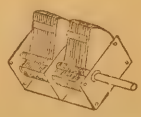
1 m/a full wave, works excellently at 5 m/a. Exceptionally small. Usual price 37/-. Our price post free **17/6**

LT53. 12 volt, 3 amp. Priced at 41/6 add 3/- postage.



SHUNTS

We make up special shunts for all radio purposes. Every multimeter needs shunts and prices are each **8/6**
Special types prices on application.



2 GANG CONDENSERS

Special gang suitable for all types of Portables and small Mantel Radios. Very well made. Only a limited quantity priced at each **12/6**

PLEASE NOTE

No matter where you live, our EXCLUSIVE MAIL ORDER SERVICE will reach you in the shortest possible time. No counter sales at present. Postage must be added. Please no C.O.D.

METERS

We carry the full range of the well known "PALEC" meter. Also we have a few good meters purchased from Disposals, as listed below:

0-1 m/a	29/6
0-20 m/a	14/11
0-40 m/a	19/11

Postage 11d.

MISCELLANEOUS

The following lines have been handpicked from our stock and we consider them worth a space in this advertisement.

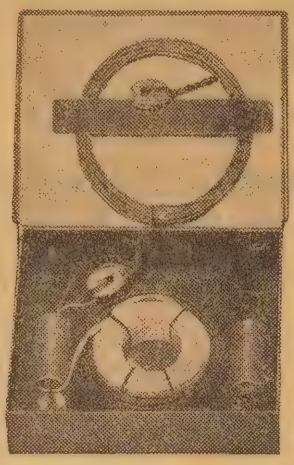
Tinned Copper Wire in either 18 or 20 gauge 5/6 coil.
Screws, Nuts, Washers 2/6 pkt.
Solder Lugs .. .. 2/- pkt.
Teletron Lugs, 3 way, 4/6 doz.
Solder, best quality, 2/- roll.
Trimming Condensers 1/4 ea.
Padding Condensers 3/6 ea.
Neon Indicators in 240 and 70 volts .. .. .. 18/6 ea.
Goldring 3 way Pick-ups light weight model .. .. 49/6 ea.
Tru-Track Cutting Heads (limited quantity) 20/- ea.
Ferrocart Sapphire Needles .. .. 10/6 ea.
Scope Soldering Irons 50/-.
Scope Transformer 47/11.
Chokes 30 H, 100 m/a 15/6.
Midget Condensers (variable): 10 mmfd 8/-; 25 and 35 mmfd 9/-; 50 and 70 mmfd 9/6; 100 mmfd 12/-.

SPECIAL NOTE

Look up our previous ads for full information on our Aluminium Chassis and Panels. Prices are worth noting.

RADIO SUPPLY Co

466 Spencer Street, Melbourne, C3



AEGIS ALL WAVE NOISE REDUCING AERIAL SYSTEM

- Latest Aegis Development.
- Available for first time in Australia.
- Eliminates noise interference in both broadcast and short-wave.

Aerial is completely assembled, no additional soldered joints. Lead-in and earth wires from aerial transformer already attached. Aerial is ready for immediate erection complete with insulators fitted.

RETAILS AT... **160/-**

System comprises:—
★ 2 specially matched Aegis transformer Units, incorp. fixed iron cored B/C. and S/W. inductances and Faraday Electrostatic Screen for max. sig. transfer.
★ 50ft twin plastic covered low impedance lead-in wire.
★ 40ft earth wire.
★ 40ft 7/22 copper aerial wire.
★ Egg insulators.
★ Complete instructions.
★ Packed in attractive coloured carton.

Obtainable from leading Retailers throughout Australia.

AEGIS

AEGIS MANUFACTURING CO PTY LTD

208 LITTLE LONSDALE ST., MELBOURNE, C.1. 'PHONE: Cent: 4414

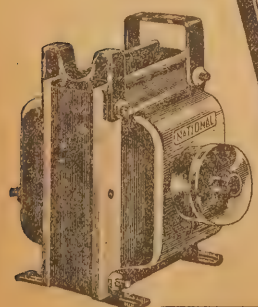
EASIEST SOLDERING...

we've ever known! .....

say... Servicemen, Mechanics, Handymen, Hobbyists, Motorists.

That's because Scope Soldering Irons incorporate all the latest features for speedy, efficient, modern soldering. See Scope demonstrated at your local supplier. Here's what you get with a Scope—Heats up ready for use in 6 seconds. Weighs 3oz, 10in long, finely balanced. Is efficient for a wide range of jobs. Particularly economical and safe. Designed so that frequent tinning and cleaning is not necessary. Operates from a car battery, or from AC mains with National Transformer optionally supplied.

Retail Price:
Iron 50/-.
National Transformer 47/11.



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SCOPE SOLDERING IRONS

Australian & Overseas Agents:

Wm. J. McLELLAN & CO. Pty. Ltd.

126 Sussex Street, Sydney. Phone: BX1131.

Manufactured by Scope Laboratories, Melbourne, Victoria.

essential) it should earth back to the same spot as the mixer coil by-pass.

The bypassing technique for the mixer valve is in principle the same as for the 6AK5 although there is no screen across the socket. This is because the plate circuit is not at the signal frequency, but at the IF of 7.3 Mc. A small partition could be mounted as shown in the dotted line between the mixer and oscillator coils to prevent inductive coupling between them, but this isn't essential.

All the coupling and bypass condensers used are of the miniature type specially made for VHF. Miniature mica condensers can be used on 50 Mc particularly with the lower gain valves, but they have a much higher inductance than the special types, and it isn't possible to keep lead lengths as short with them.

FEED RESISTORS

The positioning of the plate and screen voltage feed resistors isn't at all critical, and these can be mounted in any convenient spot. We show the 6AK5 plate and screen resistors on a tag strip at the side of the mixer coil. The others run direct to another tag strip near the power outlet grommet. To this strip is also anchored a length of co-axial cable for connecting the output coil to the receiver. Similar cable of 72 ohms enters the rear of the chassis and is tapped to the input coil.

Coupling between the oscillator and the mixer is obtained by connecting to the grid of each a short length of hook-up wire, long enough to twist together at the ends about three times. This twist forms a condenser of very small capacitance. The best or optimum coupling is obtained when tuning the mixer to resonance just begins to change the oscillator tuning by a noticeable amount. A more accurate setting would be to adjust the coupling when listening to a weak signal up to a point where the signal strength no longer improves. Within the limits of both these settings the amount of coupling is not particularly critical, provided there is enough of it.

ADJUSTMENTS

The oscillator operates on the low frequency side of the signal frequency which covers 50-54 Mc. This makes the oscillator tuneable from 42.7-46.7 Mc, and the first step in finding the band is to set the oscillator frequency. If you know that a strong station is on the air nearby, it should be possible to hear a signal from it by carefully adjusting the oscillator trimmer from about one-third to three-quarters mesh. The trimmers on the other coils should be backed almost completely off during this process.

Another method is to set the oscillator frequency with a grid dip oscillator or even an absorption meter which will tune fairly accurately. If you have a receiver covering the band you can do the job by listening to the oscillator with it. Naturally the receiver into which the converter feeds is first of all tuned to 7.3 Mc.

Having found the band and assuming you have heard a signal either from a station or some reliable source near 50 Mc the oscillator should be adjusted to tune it in with the tuning gang nearly full in mesh and the RF and mixer coils peaked for greatest strength. Should either of these trimmers not peak even when at minimum

Convert Your Gramophone to a real

TAPE RECORDER

FOR ONLY

£12/10/-

COMPLETE

GRAMOTAPE KIT

comprises

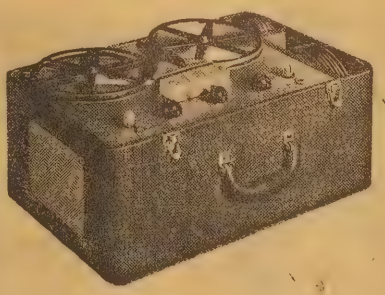
1 REEL E.M.I. TAPE, 1200ft.
1 TAKE UP REEL.
1 CLUTCH SYSTEM.
1 RECORD/PLAYBACK HEAD KIT (HIGH IMPEDANCE).
1 ERASE BLOCK.
2 CORNER BRACKETS.
1 ROLLER.
1 3 x 2 x 1 RECORD SWITCH.
1 OSCILLATOR COIL & ALL RESISTORS AND CONDENSERS, INC. VALVE SOCKET.
FULL VERY EASY INSTRUCTIONS

The results from this super little recorder are amazing. You can record direct from the radio or microphone with quality usually associated with high priced recorders. This GRAMOTAPE recorder uses your turntable as the flywheel and the radio as the amplifier. All you need is a little radio knowledge to follow a very simple one valve circuit for the oscillator coil cum-pre-amp, and there it is, all ready to record. NO PARTS TO MAKE. All that's required is a soldering iron, plyers, and screwdriver.
Come in for a demonstration of this new, inexpensive recording idea that has been outstandingly successful in England for a long time.

Magnetic Tape Recording Heads

High Impedance, Record/Playback head kit, wide frequency range, very simple to assemble. Kit contains, Wound coil on bobbin, MU METAL strip, stalloy packing, solder, chrome case, single hole mounting. £1/12/-, inc. tax.
LOW IMPEDANCE. Record/Playback head kit. Contains MU METAL strip, coil wire, solder, chrome head case, single hole mount. 17/6, inc. tax. Very simple instructions.
ERASE HEAD. Low impedance. Contains coil wire, solder, chrome head case.
O.M.E. Supersonic Oscillator, coils, 40kc adjustable slug. A truly first-class coil in shield can. Complete with circuit, 18/6.
MU METAL STRIP heat treated. 3/-, 6/- per strip.

Magnetic Sound Industries (Aust.) stock



COMPLETE RECORDERS

Is Australia's only tape recording specialist and as such has the largest range of branded and guaranteed tape recorders. They recommend and stock only the leading makes, such as **MAGIC-TAPE, ELCON, SOUNDMIRROR, EDISWAN, B.S.R., SIMPHONIC,** as they are good quality instruments and require the minimum of service. They are obtainable for as little as from **£19/10/-** deposit and easy weekly payments. New and Secondhand.

RECORDING ACCESSORIES DEPARTMENT

This new dept. of Magnetic Sound Industries is now fully stocked and offers the following for the home constructor.

Record/playback head kits from	17/6	CHROME REEL HOLDERS	12/6
Erase head kit	17/6	PLUGS, JACKS	4/6
Oscillator coils (inc. circuit)	18/6	PANELS, ETC.. SOLD SEPARATELY..	
MU METAL strip	3/-, 5/4, 6/6		
Head cases (chrome)	12/6		
Empty reels, all types	6/6, 8/6, 10/6		
Tape from (E.M.I., Scotch Boy, etc.)	£2/2/-		

RADIOGRAM CABINETS

Solid core, originally made for £200, Recorder Grams to clear £28/10/-.

EASY TERMS ON ANY ARTICLES. MAIL ORDER WITH CONFIDENCE.
On any type of recording equipment, consult Australia's only specialist.

MAGNETIC SOUND INDUSTRIES (AUST.)

1st Floor Crystal Palace Arcade (opp. Regent Theatre)

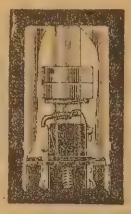
590 GEORGE STREET, SYDNEY. M3393

OPEN SATURDAY MORNINGS.

"Q-PLUS" Band-Pass Aerial Kits.

STANDARD SIZE—TYPE AC5 & AC8
MINIATURE SIZE—TYPE AC1 & AC3

To accomplish band pass tuning two matched aerial coils are required. The above types are those recommended for this purpose. The AC5 and AC1 are to be used in the first section being coupled by a common .02 mica condenser for the low frequency end and by a 2-3 pf. condenser at the high frequency end. Whilst types AC8 and AC3 belong to the second section.
With correct use 10 Kc band width may be obtained using these coils.
We recommend that prospective users refer to Radio & Hobbies December issue.



AC5

AC1

SPECIFICATIONS

Type AC5 has previously been covered.
Type AC8 is identical with the exception that no primary is wound.
Type AC1 has previously been covered.
Type AC3 is identical with the exception that no primary is wound.

CONNECTIONS

	AC3	AC8
Grid	G	1
Bottom coupling cap	F	3

REMARKS

To enjoy the fullest fidelity with these coils it is urged that Type IF12A and IF13 be used in the miniature size and 2—IF15 in the standard size—these are 1600 Kc and 1900 Kc IF's respectively and require type 010 and 011 oscillator coils respectively.

"Q-PLUS" IF. 14 & 15 I.F. Transformers

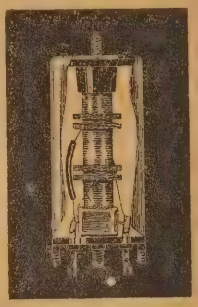
STANDARD SIZE 1900 KC IF's

Physical Size 1⅜in diam. x 3in high.

Mounting—2 x ⅛in holes 1⅜in apart.

Pin Connections

1 . . . . . Grid
4 . . . . . Plate
3 . . . . . AVC
6 . . . . . Br.



I.F. Frequency . . . . 1900 Kcs

Transformer Gain

IF 14 5
IF 15 5

Winding "L"
(When tuned to 1900 Kcs)

Winding "Q" 140 in can

Coupling Factor

IF 14 . . . . . .4 K
IF 15 . . . . . .5 K

Tuning Capacity 100 uufd.

REMARKS

A general purpose 1900 Kc pair of IF's when IF14 is used in first position and IF15 with second. However by using an IF15 in first and second position an ideally wide band is obtained — see graphs for actual figures. Usual non-softening base with silver plated pins are employed. Litz wound windings.

R. W. STEANE & Co. Pty. Ltd., Auburn, Vic.
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

"Q-PLUS" I.F. 12, 12A & 13 I.F. Transformers

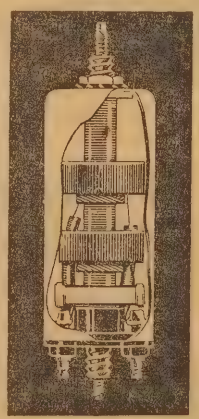
MINIATURE SIZE 1600 KC IF's

Physical Size ⅜in x ⅜in x 2in

Mounting 3-16in Whit nut onto moulded insert in base — Gummed template supplied.

Pin Connections

P = Plate
G = Grid
B+ = B+
F = AVC



Transformer Gain

IF 12 4
IF 12A 4
IF 13 4

Winding "L"
(When tuned to 1600 Kcs)

Winding "Q" 90 in can

Tuning Capacitor

Coupling Factor

IF 12 . . . . . .7 K
IF 12A . . . . . .8 K
IF 13 . . . . . .9 K

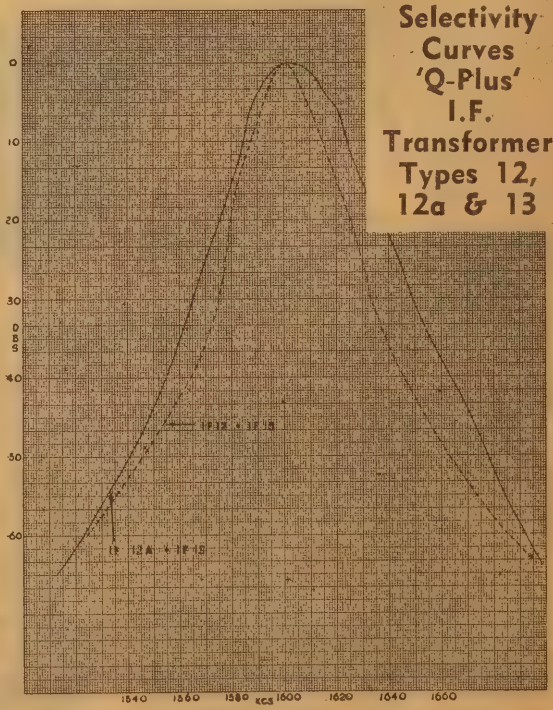
REMARKS

This combination of midget 1600 Kc IF's offers a vast range of band width characteristics —see graph for details.

Usual Q Plus midget specifications of non-softening base, silver plated pins, etc., are employed. Semi-potted construction.

R. W. STEANE & Co. Pty. Ltd., Auburn, Vic.
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Selectivity Curves 'Q-Plus' I.F. Transformer Types 12, 12a & 13



R. W. Steane & Co. Pty. Ltd., Auburn, Vic.

capacitance the coils should be sprung out to increase spacing and reduce inductance. In some cases where circuit constants vary somewhat from our own it might even be necessary to remove a turn from one of these coils.

In calibrating the receiver it is really necessary to have some source of signal which can be heard in the receiver from 50-54 Mc. We happened to have a Cardwell frequency meter available for this job, and many amateurs have similar meters, generally made by Bendix, which you could borrow. In all events it should not be very hard to enlist someone's assistance in calibration. There are quite a few stations operating between 50 and 52 Mc the frequencies of which can be ascertained and used to plot dial points.

As the two trimmers are peaked with an aerial attached you should be able to hear the noise level rise. Peak them at 50 Mc, tune to about 54 Mc and see whether they are still in line. If you have to back them off, the taps on the coils should be moved nearer the earthed end of the coils, and vice versa. A similar effect and a finer adjustment might be made by spacing out or closing up the three turns between the bandspread tap and the earthed end of the coils. We were maybe a little fortunate in striking almost exact tracking right away. In practice perfect tracking is probably only important between 50-52 Mc, as at present there are virtually no signals in the higher section of the band.

Do not alter the main receiver tuning from 7.3 Mc while lining up the converter. You will throw out the calibration if you do. In fact, you can easily tune in stations over a small portion of the band by using the receiver dial. It would, however, require broad-banded RF circuits for this technique to be used as a regular thing.

FROM THE SERVICEMAN WHO TELLS

(Continued from Page 45)

This was to prepare wires to join to the existing ones and for these two short lengths of fine tinned copper wire were selected. Each was wrapped around a heavier gauge of wire for about a quarter of an inch, thus forming a short helix with a slightly larger internal diameter than the wire to which it was to be joined.

It was now a relatively easy job to push the helix over the short end of the broken wire and apply a blob of solder with the special bit. The operation was successfully completed with the other wire and from here on the job was more or less plain sailing.

My friend was rather proud of his achievement—and rightly so I think—because the job had, at first glance, appeared almost hopeless. Of the remainder of the valves, two were found to have loose bases and the other two, by some miracle, appeared to have escaped injury of any kind. The loose bases were eventually made serviceable again and the set restored to working order, the DOL being gently advised that it would be better to let the serviceman remove the valves in future.

(I have just realised that I never did discover what really caused the set to fail, though it was probably only a simple fault. Anyway, I gather it was NOT a valve.)

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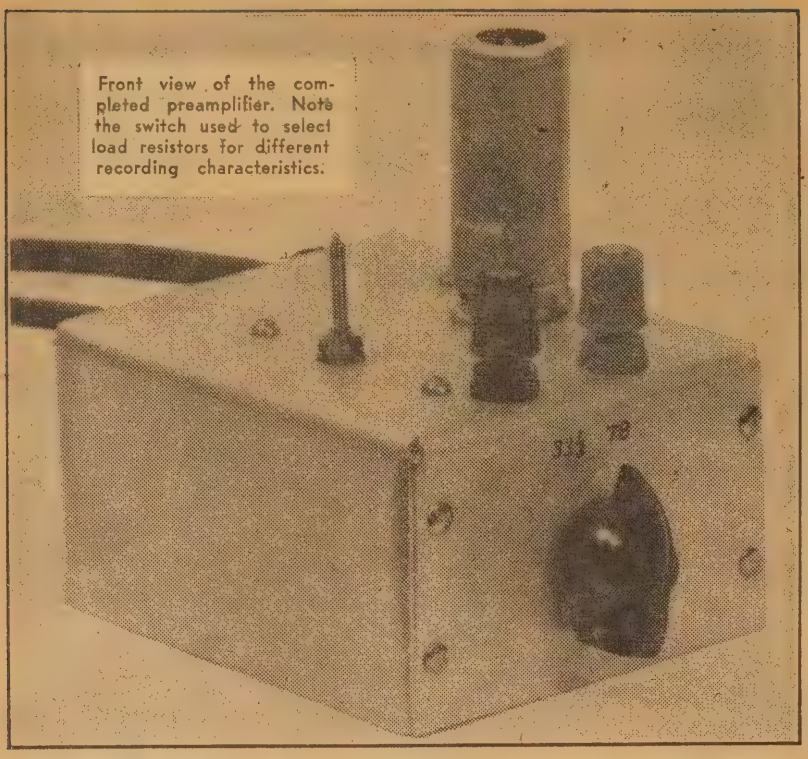


Front view of the completed preamplifier. Note the switch used to select load resistors for different recording characteristics.

A PRE-AMP. FOR XTAL PICKUP

Although a crystal pickup will generally provide enough volume when played "straight" through a radio set, this may not be so after applying compensation necessary for best results. This pre-amplifier features the correction pad recently described for the GP20 pick-up plus enough extra gain to build up output. It can be attached to almost any radio.

by Philip Watson

THERE seems to be little doubt that, for the average listener at least, the crystal pickup is at present by far the most popular. There are many reasons for this, not the least being the moderate cost and ready availability. Other advantages are the light weight and high compliance of modern designs which reduce record wear to a minimum, plus a fairly high output, which, in most cases, means that it can be fed straight into the pickup terminals of a commercial receiver.

PICKUP CHARACTERISTICS

However, the fact that such a simple set-up will give results of a kind does not always mean that these results are the best that can be obtained, and it is really well worth while to take a little care to ensure that the pickup is working under the best possible conditions.

Among the factors which have to be considered are the characteristics of the pickup (these vary considerably from one make to another), the response of the remainder of the system, the load which the pickup terminals present and the type of record which is to be played — that is, whether standard or microgroove.

The first point to be considered with any crystal pickup is the effective load into which it works, since this has a marked bearing on the bass response without affecting the treble end. In order to provide a degree of bass boost which will compensate for the normal recording characteristic it is normal to use a load value of approximately .5 megohm, with the proviso that higher values will increase the bass response and lower values decrease it.

The load presented by a pair of pickup terminals on a commercial receiver can be very much of an unknown quantity, and the least that should be done with any installation is to check this point and, if necessary, modify the circuit to provide the correct load.

By far the best arrangement in such cases is to provide a change-over switch (if the set does not already possess one) which will divert the "hot" end of the volume control from the detector circuit to the pickup terminal, the value of the volume control being selected to suit the pickup.

With some types of crystal pickups such precautions may be quite sufficient, at least for playing standard 78 rpm records. For microgroove heads some further modifications may be necessary, such as a higher value of load resistor to compensate for the altered bass recording characteristic, and some form of top cut filter to provide the necessary "de-emphasis" of the treble response. In many cases quite satisfactory results can be obtained by using the normal tone control for the latter function.

TREBLE RESPONSE

All the foregoing assumes that the response of the pickup in the treble end is reasonably flat, but, in practice, this is seldom so, and it is frequently desirable to provide a measure of correction for best results. This subject was very fully covered in an article by Neville Williams in the November, 1952, issue, and, rather than simply repeat all this data, we suggest the reader refer to this article.

Briefly, however, it concerned the rather objectionable peak at about 5 or 6 Kc which is a characteristic of the GP20 and similar types. The effect of this peak is twofold. It upsets the balance of reproduction by giving undue prominence to any signals at that frequency and exaggerates harmonics produced at lower frequencies. The net effect can be very unpleasant.

Secondly, there is the effect on scratch level and, as we have pointed out on previous occasions, this is always aggravated by any prominent peaks in the treble response curve. Thus, the elimination of the 5 to 6 Kc peak can be expected to improve both the overall balance of reproduction and the "signal-to-noise" ratio.

A simple network to achieve this, and, at the same time, to improve the response up to the region of 10 Kc, was described in the November article. The original idea was to make the GP20 suitable for use with high-quality amplifiers, such as

the Playmaster series, which employed bass boost circuits to compensate for various recording characteristics.

MAGNETIC PICKUPS

Since good-quality magnetic pickups, for which these amplifiers were originally designed, have normally a level response in the bass region, it was necessary to make the crystal types behave in a similar manner. This was done by reducing the value of the pickup load to about 20,000 ohms.

In these circumstances there is no natural bass boost on the part of the pickup, and this is then provided by the amplifier. In some respects this is a better method, since the output from the pickup is smoother when working into a low value of load and the final bass response curve, after correction, is free from objectionable humps.

Another characteristic of the magnetic pickups is that they have a relatively low output, certainly much lower than crystal types, so that amplifiers intended for use with them normally have a much higher gain than a simple two-stage affair consisting of a voltage amplifier and a power valve, such as usually constitutes the audio end of a modern receiver.

PAD LOSSES

For this reason losses introduced by the compensating pad, far from being a serious objection, were really desirable to avoid overloading the early stages of the amplifier. However, when it is desired to use a crystal pickup and the compensating pad with a standard commercial receiver the position is quite different, because there is neither a bass boost circuit nor, in most cases, sufficient gain to provide full output from the much reduced input.

In order to overcome these problems we have designed the preamplifier unit about to be described. The lack of bass boost is overcome quite simply by selecting correct values of load resistors. Two values are provided, one to suit standard 78 rpm records and the other to suit microgrooves.

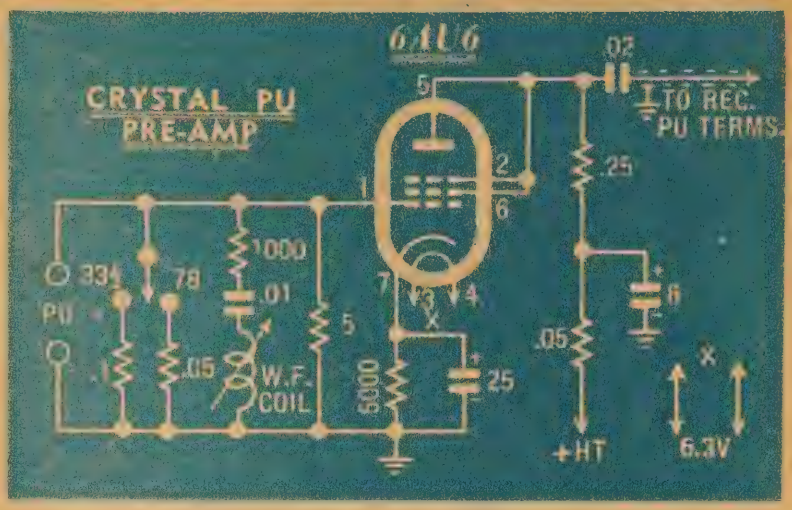
Following this, we have the compensating pad to minimise the 6 Kc peak, plus a stage of amplification to offset the losses due to compensation. The unit is designed to operate from the power supply of the main amplifier, which should be quite capable of supplying the additional 300 mA heater current, while the HT current is negligible.

The whole unit is constructed on a small chassis measuring 4in x 3¼in x 2in deep and a good idea of the layout can be obtained from the photographs and wiring diagram. Our original chassis was constructed from aluminium, but we suggest that a ready-made steel chassis would be a better proposition for the home constructor and are preparing a blueprint for the chassis manufacturers.

COMPENSATING PAD

The compensating pad consists of a 1000 ohm resistor, a .01 mfd capacitor and a standard whistle filter coil as originally designed for use with the Radio and Hobbies Wide Band Tuners. This whistle filter coil is now available commercially in a number of brands or, if you prefer, you can wind your own from details contained in the accompanying diagram.

CIRCUIT DIAGRAM OF PRE-AMP



The circuit of preamplifier is quite simple and should not present any difficulties, even for the beginner. Note the switch which selects the required value of load for different recordings. The compensating pad is immediately to the right of this.

We used a commercial version on this occasion and the one we chose was fitted with an ingenious mounting bracket which only needs to be forced through a suitably sized hole in the chassis in order to provide a firm mounting. A 5-16in hole appears to be the correct size. For best results with the commercial coil, the adjustable slug should be screwed right out, while it can generally be omitted altogether in the case of the home-made coil.

The amplifying stage consists of a 6AU6 valve, operating as a triode, the amount of gain provided by this arrangement being quite adequate, whereas that provided by the pentode connection would, in most cases, be excessive. The 6AU6 is operated as a triode by connecting the screen, suppressor and plate together and treating as the plate. The gain provided is in the order of 20 to 25 times.

The HT supply to the unit is decoupled, both to eliminate any small amount of ripple which may still be present and which may show up with the additional amplification, and to prevent any coupling between stages which could otherwise lead to instability in the form of "motorboating." The decoupling circuit consists of a .05 meg. resistor and an electrolytic capacitor of 8 mfd or higher, though we did not find it necessary to use a larger value.

In our version we mounted the load selecting switch on the front of the chassis but in some cases it may be more convenient to mount it elsewhere. For example, if the preamplifier has to be tucked away in a remote corner of the radio cabinet, there is no reason why the switch and the two load resistors should not be mounted under the motor board with the shaft passing through to a suitable knob above.

PARTS LIST

- 1 Chassis 4" x 3¼" x 2".
- 1 6AU6 valve.
- 1 Miniature 7 pin socket and shield.
- 1 .5 meg. ½ watt.
- 1 25 meg. 1 watt.
- 1 .1 meg. ½ watt.
- 1 .05 meg. 1 watt.
- 1 .05 meg. ½ watt.
- 1 5000 ohm 1 watt.
- 1 1000 ohm ½ watt.
- 1 25 mfd 40 volt electrolytic (midget).
- 1 8 mfd 350 volt electrolytic.
- 1 .01 mfd paper capacitor.
- 1 .02 mfd paper capacitor 500 volt.
- 1 Whistle filter coil (see text).
- 1 Single pole, two position switch. MSP series 20, type 23.
- 2 Terminals.
- 1 Yard PTIM co-axial cable.
- 2 8 terminal tag strips.
- 1 Pointer knob.

Hook-up wire, solder lugs, grommet, plastic tubing, nuts and bolts, &c.

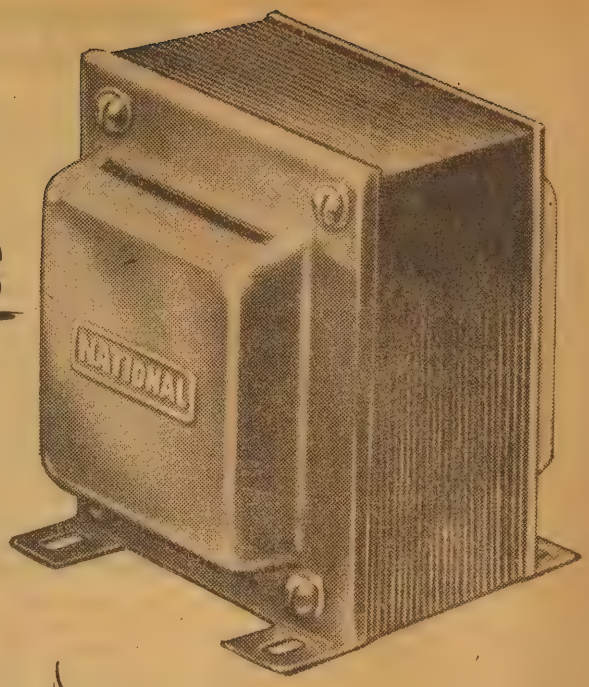
LAYOUT

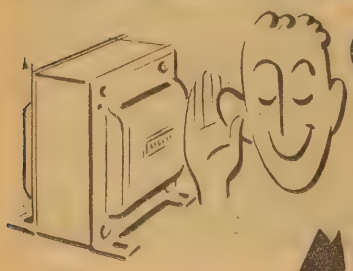
On the other hand it may be possible to adhere to the original design and mount the whole unit under the motor board with the switch shaft extended to the other side. Much depends on the available space and other factors, and is best left to the individual reader to decide. However, don't mount the unit too close to the motor or transformer else hum may be a problem.

Near the front of the chassis is mounted an eight terminal tag strip. On this is mounted the 1000 ohm resistor and .01 mfd capacitor which form part of the compensating network, the .5 meg. grid resistor for the 6AU6, and the leads to the whistle filter coil. Both resistors should be ½ watt, while the .01 mfd capacitor can be one of the midget paper type.

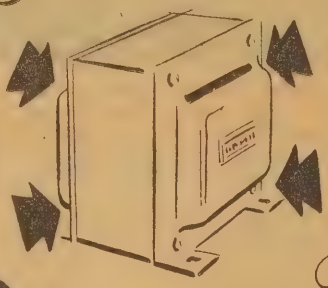
Alongside the valve socket is mounted the bias resistor, a 1-watt type, and the 25 mfd electrolytic by-pass capacitor. This latter should also be of the midget type, though

SEVEN Essential Features

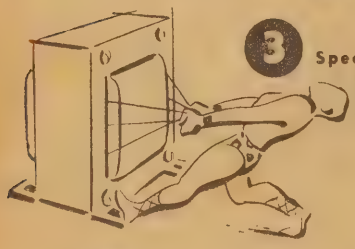




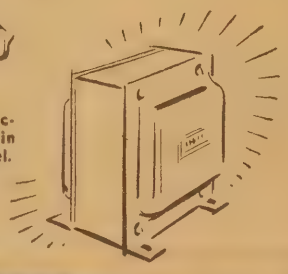
1 Special built-in features have completely eliminated lamination hum.



2 Scientifically placed louvres permit up draughts of cool air past windings, thus ensuring lower working temperature and added safety.



3 Special anchoring method prevents leads being pulled out.



4 Covers are attractively finished in grey stoving enamel.

5 Coil is impregnated with special varnish and baked to resist humidity.

6 Modulation hum is further minimised by high tension secondary windings inversely connected, and by an electro-static shield.

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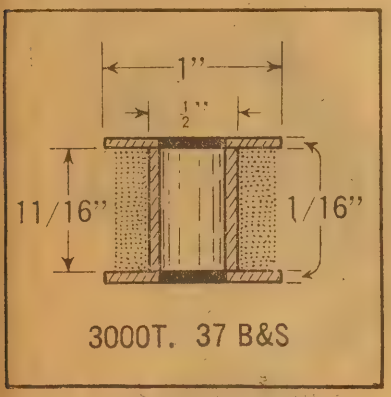
it may be possible to squeeze one of the larger ones in at a pinch.

Toward the rear of the chassis is mounted another eight terminal tag strip. This provides anchor points for the incoming leads and carries the remaining components. These are the .25 meg. plate load resistor, the .05 meg. decoupling resistor, the 8 mfd decoupling capacitor, and the .02 mfd paper coupling capacitor.



Here are the constructional details of the whistle filter coil for those who may care to make their own. The bobbin is of moulded plastic and should be readily available. No iron dust core is normally necessary.

The incoming leads are the two filament leads, the HT lead, an earth lead to connect the two chassis together, and the shielded cable to connect the output from the preamplifier to the receiver pickup terminals.

The two filament leads and the HT lead run to terminals on the tag strip while the earth lead connects to a convenient earth connection. From the tag strip two wires connect to the socket filament pins and it should be noted that the filament circuit should not be earthed, since this will already have been done on the main chassis. An additional earth connection could cause a short circuit of the filament line.

For the shielded output cable we used a length of PT1M co-axial cable which has the advantage of low capacitance between the conductor and shield together with excellent mechanical qualities. The outer shield is connected to an earth lug on the terminal strip and the centre conductor to an adjacent terminal to which is also connected one side of the coupling capacitor.

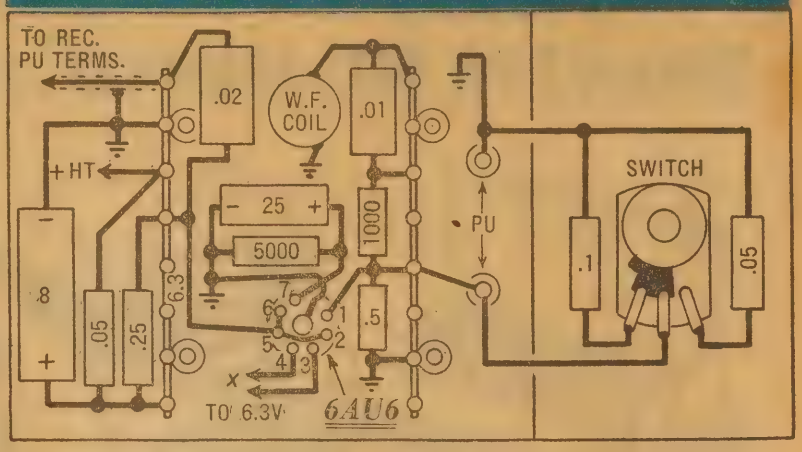
It is important to anchor the outer shield firmly in order to prevent any undue strain being placed on the relatively light inner conductor which might otherwise break if the cable is subject to any amount of handling.

To make a neat job, first remove about an inch of the outer plastic sheathing and then unravel, do not cut, the length of copper braid which is revealed. This braid may now be twisted to form a short length of wire which is passed through the rivet of the earthed tag on the terminal strip, pulled tight, and soldered. The inner conductor may now be trimmed to length and soldered to the adjacent terminal. This will make a firm job in which all the strain is taken by the outer braid.

A neat job of the power wires can be made by enclosing them in a length of plastic tubing, while it is a good idea to protect them with a rubber grommet where they pass through the chassis.

The manner in which these wires are connected to the main chassis will depend partly on the design of the latter and partly on the way in which it is to be used. If the unit is to become a permanent part of the system there would be no objection to connecting the leads directly into the circuit, bringing them out through any convenient hole in the chassis or drilling an extra one if necessary.

WIRING DIAGRAM OF PRE-AMP



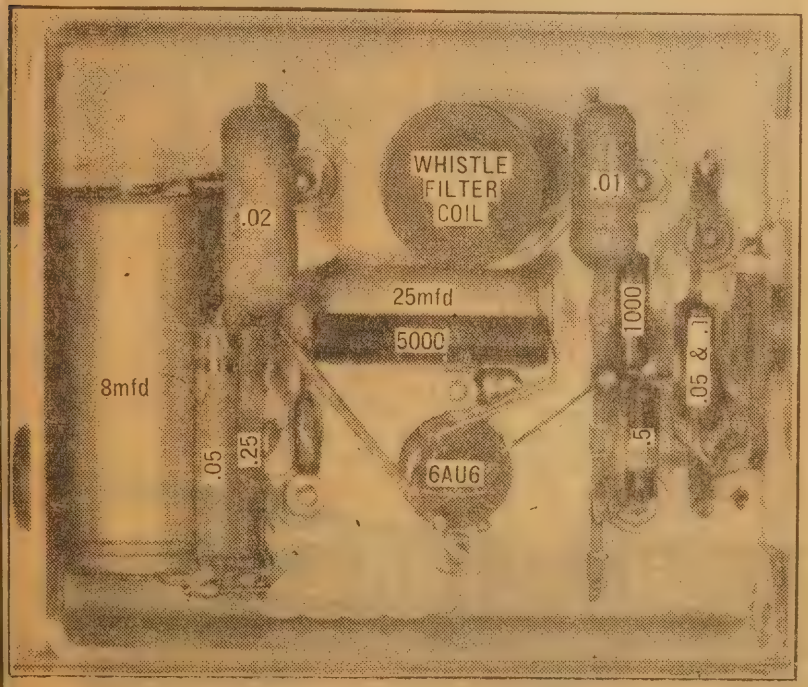
This wiring diagram, studied in conjunction with the under-chassis photograph should assist the beginner to lay out the components as in the original. Note the use of tag strips to support most of the components.

MAIN AMP. IMPEDANCE

If there is a chance that the unit may be required to operate with more than one piece of equipment it would be better to make the connection less permanent and an outlet socket, say a four or five-pin valve socket, could perhaps be mounted on those chassis with which it is to be used, each wired to the appropriate points under the chassis. The cable from the unit is, of course, fitted with a corresponding plug.

The impedance presented by the pickup terminals to the preamplifier should ideally be greater than .25 meg (the value of the plate load resistor) and if it is appreciably less than this it is probable that distortion will occur before a useful level has been reached. In most cases the value presented by a commercial receiver will lie within reasonable limits and it is not so critical as it is when the pickup is fed directly to the terminals.

(Continued on Page 81)



Under-chassis photograph showing how the finished unit should appear. The decoupling capacitor is on the extreme left, the whistle filter coil at top centre, and the load selection switch at the extreme right. The two load resistors are mounted one above the other and the lower one is hidden.

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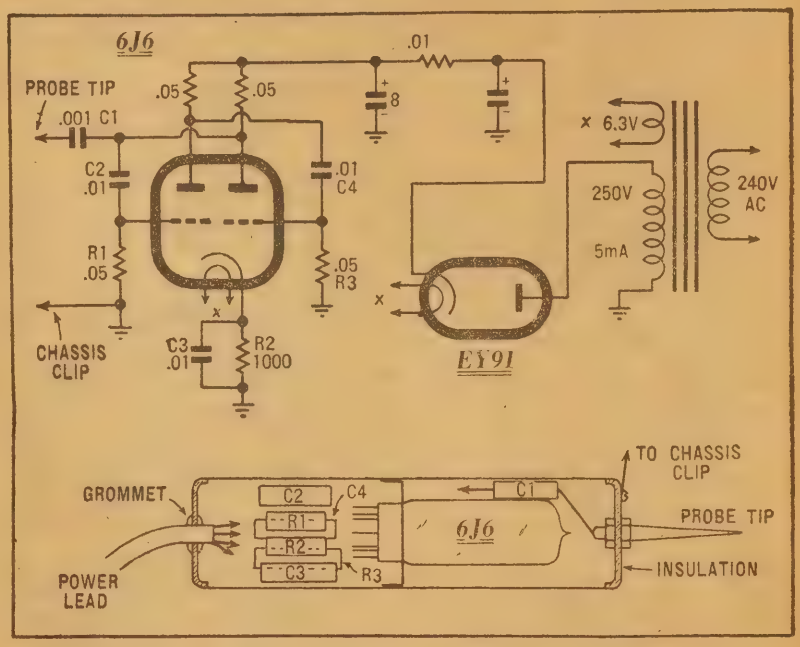
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

INJECTION TYPE SIGNAL TRACER FITS INTO A PROBE

Many servicemen are aware of the facility afforded by a multivibrator unit for rapid checking of circuit alignment. However, when constructed so that it can be used also as a probe-type signal tracer, its usefulness is greatly increased. Here is one design of such a unit submitted by Mr. R. Rollins of 16 Marns St., Wagga Wagga, NSW.



MR. ROLLINS' requirement for a versatile but inexpensive piece of test equipment for preliminary checking of receivers will no doubt run parallel with that of many other readers. To present the background to Mr. Rollins' thoughts, we will let him tell his own story.

". . . I decided to build a signal tracer, but found that my pocket woud not stand the expense. Most tracers contained a diode or pentode probe, a high-gain amplifier consisting of two RF pentodes, which may be used as AF amplifiers, an output stage, a visual indicator together with a power supply—too expensive and bulky for my requirements.

"However, I came across an interesting approach in that the set under test is used as the amplifier and the signal tracer as a generator which could feed either AF or RF into the set. Signal tracing then starts at the speaker.

A MULTIVIBRATOR

"A generator which will supply both AF and RF signals without switching takes the form of a multivibrator operating on a fundamental frequency of about 1000 cycles. Its output waveform is very rich in harmonics, which are audible well into the short-wave bands.

"The circuit follows usual practice, but the use of a miniature twin triode permits the valve to be enclosed in the probe case. I used a probe of copper tubing about 1¼in diameter and 5in long. The components marked on the circuit are those which are housed in the probe. The power supply is on a separate chassis. The original used an EY91 as a half-wave rectifier, but other rectifiers or diodes may be used. Almost any power transformer may be used.

"This operation of the unit is as follows. Switch both the set and tracer on and allow to warm up. Clip the probe case to the chassis and apply the probe tip first to the aerial terminal of the set and then to the pick-up terminal. In both cases, a loud signal should be heard, even before the probe tip makes contact.

"Before using the tracer on a faulty set, carry out the usual initial checks on the power supply, electrode voltages and wiring. Begin tracing at the speaker by clipping the probe case earth clip to one side of the speaker transformer and touching the probe tip on the other side. Have the set switched off for this test. This checks the transformer, speaker voice coil and interconnecting wiring.

"Now attach the probe earth clip to the set chassis, where it remains for the remainder of the tracing, for which, of course, the set should be switched on. Signal tracing from here on is simply a matter of going from one stage to the preceding one. It is the same as in conventional signal tracing except that it is in reverse.

SIGNAL TRACING

"The signal tracer tends to overload a sensitive stage giving the impression of distortion when it really does not exist. This can be avoided by approaching the test point with the probe tip, but not actually touching it."

That's the story as told by our contributor. Note that other miniature twin-triode valves, such as the 12AT7, 12AU7, 12AX7, &c., may be used. It may well be worth while including the two .05 megohm plate load resistors and the other .01 mfd coupling capacitor in the probe to minimise radiation from the leads between the probe and the power supply.

With reference to our contributor's last paragraph, two tips could be fitted to the probe, one coupled as shown, and the other coupled to the same output plate through a very small capacitor of a few pf in value, such as two pieces of insulated hook-up wire twisted together for a turn or so. This second tip would be a "low output" one for checking sensitive stages.

CAMERA SETTINGS

WHEN making camera settings from a dial-type photo guide, a paper clip will assist you in two ways. Placed in the proper position, it will mark selected settings for quick reference or recheck. The clip also will hold the various dials in place so that they will not accidentally be shifted while the guide is being handled. Should you ever put your camera away loaded and later forget what type of film it contains, a glance at the guide, with the paper clip still attached, will give you the answer.

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CONCRETE SLABS FOR THE GARDEN

This month we shall consider slabbing concrete in paths and other garden features. There is nothing very complicated in the methods, and as no more material is used than in making and laying concrete, it will be seen that the little extra effort is well worth while.

PART 2

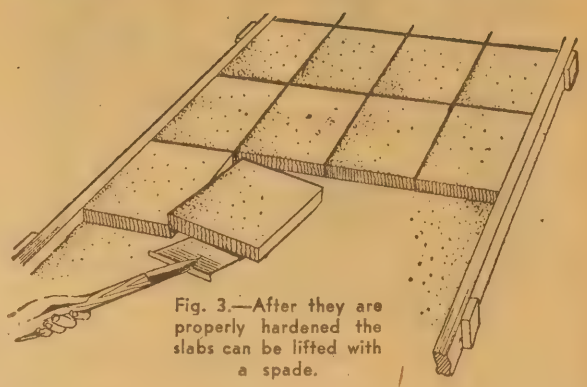

Fig. 3.—After they are properly hardened the slabs can be lifted with a spade.

THIS is the simplest method of making slabs. An area of concrete is laid between simple formwork, exactly as described in the previous article. The concrete mix in most cases, as for all slab work, is three parts sand and one part cement.

The ground being levelled, the formwork is laid in place and secured to pegs driven in the ground. It is suggested that the timber for the formwork be 2in thick. Before the concrete is placed, a layer of sand ½in thick is laid and raked level with a garden rake. The concrete is then placed on this and levelled with a wood screed. The screed is a length of board about 6in longer than the width of the formwork. It is used first with a chopping action and then backward and forward like a saw. The result is a slab 1½in in thickness, the underside of which will have an attractive sanded finish. When the slabs are used, this undersurface becomes the face side.

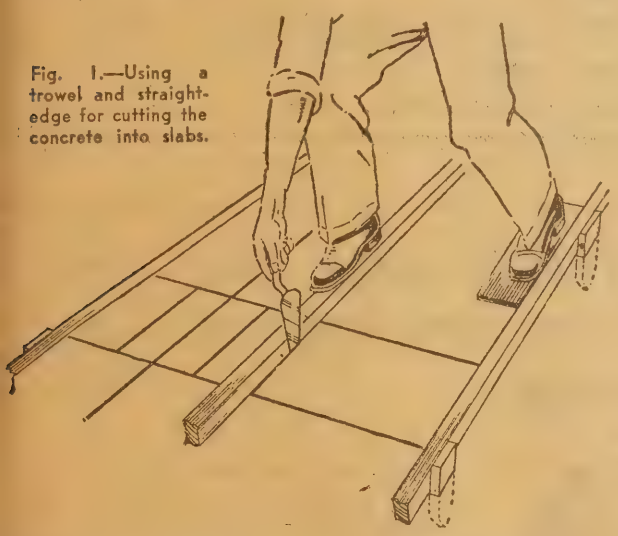

Fig. 1.—Using a trowel and straight-edge for cutting the concrete into slabs.

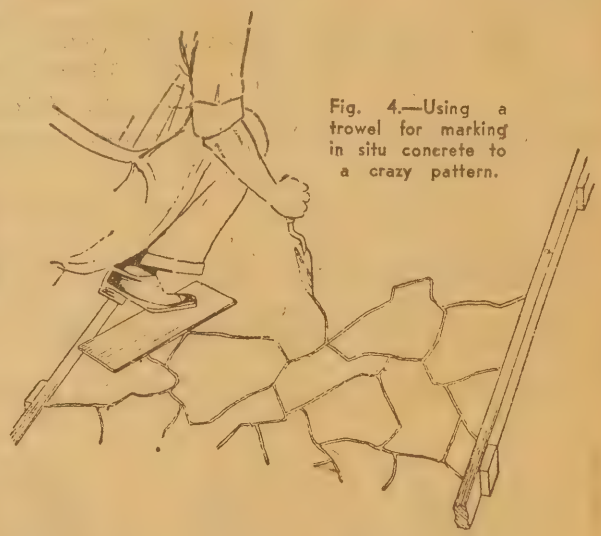

Fig. 4.—Using a trowel for marking in situ concrete to a crazy pattern.

After one to three hours, depending on temperature conditions, the concrete may be cut into slabs. For this a trowel and straight-edge are used, as shown in Fig. 1. This also shows the formwork and pegs. The concrete is cut through to its full depth, and one foot holds the straight edge steady, as shown.

The size of the slabs will depend upon personal preference, and the use to which they are to be put. Fig. 2 shows alternative arrangements for slabs used for paving, using slabs of one, two and three different sizes. The sizes will, of course, be determined before the formwork is laid, so that its width and length will produce an exact number of slabs.

LIFTING THE SLABS

The slabs are left for four or five days to harden and are then lifted with a spade, as shown in Fig. 3. During this four or five days they should be protected from the effects of sun and drying winds, so that they harden gradually. Wet sacks are ideal for protection, but if this is impractical, frequent sprinklings with a watering can will help. After lifting, the slabs are stacked on edge to mature until required, and the longer the time that can be allowed at this stage, the better.

Before the laying of the path is dealt with, another method of achieving something of the appearance of a paved path can be described.

The concrete is laid on the site and to the exact size of the proposed path, and after an hour or two it is grooved with a straight-edge and trowel to

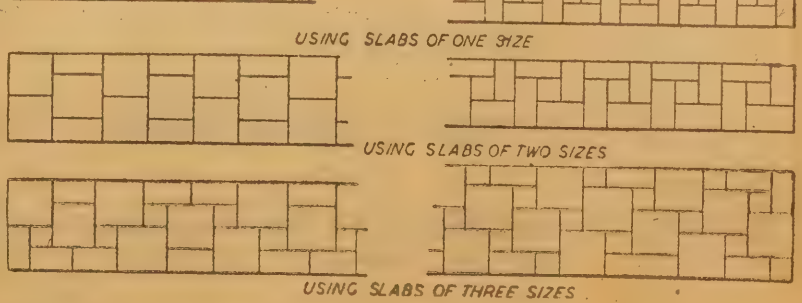

Fig. 2.—Alternative patterns for laying slabs used for paving.

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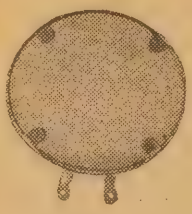

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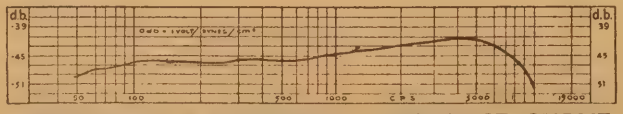

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the appropriate pattern. The marks are made in parallel lines ½in deep and ½in apart.

When the whole slab has set, the concrete between the lines is removed. Paths of this kind should be provided with expansion joints formed of ½in thick battens laid across the formwork at intervals no greater than 8ft. The appearance produced is similar to actual paving at first glance, though the little extra trouble of making the slabs might be considered as worth while, especially if, as suggested later, colored concrete is used.

LAYING THE SLABS

The top soil is removed from the site of the path and the site levelled. A bedding mixture of one part cement to four parts sand is then spread. This bedding may be mixed with very little water to make a granular, crumbly concrete, or it may be laid completely dry. In the latter case, the slabs are soaked in water just before laying and sprinkled generously after laying, thus providing enough moisture to set the bedding. Each slab is gently tapped down on the bedding until it is level and there is no rocking. A wooden mallet or block of wood is used for this.

The slabs may be kept ½in apart, or butted close together. If joints are left, they may be filled with a contrasting colored mortar, or filled with soil for the reception of low-growing plants.

COLORED CONCRETE

Concrete may be colored by the addition of ordinary dry colors bought from an oil and colorman, but it is best to buy the specially-made coloring powders. These have a high degree of penetration and staining qualities and are non-fading. They are added to the cement when dry and before the sand is mixed in, at the rate of 10lb of coloring powder to 1cwt of cement. They are sold in a number of colors, and these are intermixable. It is possible, therefore, to vary the mix slightly so as to produce different colored slabs and a very attractive path.

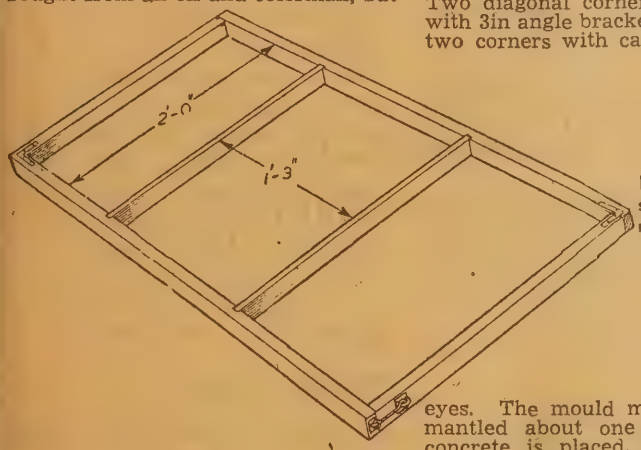

Fig. 5. — An assembled mould for making rectangular concrete slabs.

CRAZY PAVING

This is produced in exactly the same way as rectangular slabs, and Fig. 4 shows the concrete being cut to its full depth. Crazy paving is bedded and laid as described above, the straight-sided pieces being used at the side of the path. In situ concrete can also be marked with the trowel in a crazy pattern.

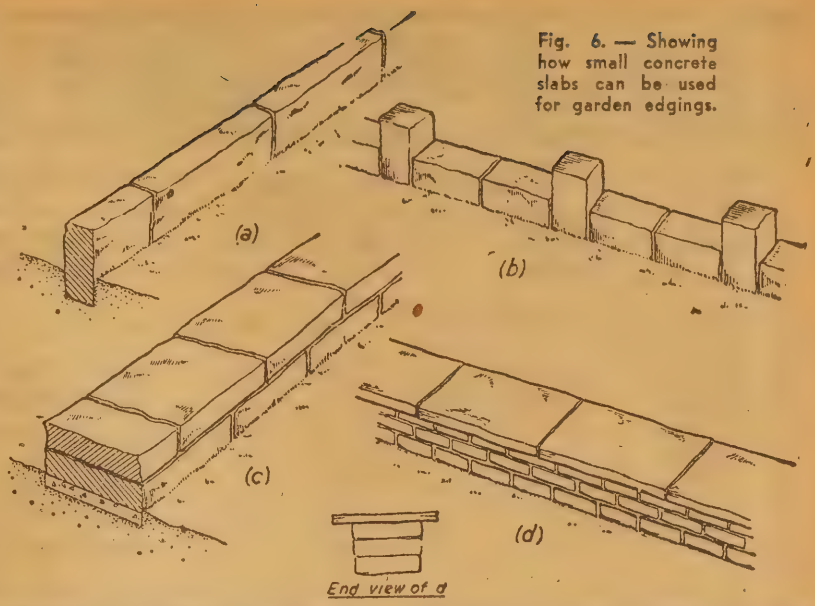

Fig. 6. — Showing how small concrete slabs can be used for garden edgings.

CONCRETE SLABS

This method has certain advantages as the slabs may be made in the garden shed in wet weather, and also the color variations can be made more definite in succeeding batches of slabs. Fig. 5 shows an assembled mould for three slabs. The frame of this mould is of 1½in x 1½in timber, and the divisions of 1½in x 1½in wood. Two diagonal corners are secured with 3in angle brackets, and the other two corners with cabin hooks and eyes. The mould may thus be dismantled about one hour after the concrete is placed, and then reassembled and another batch of slabs cast. You will, however, need another pair of divisions, as it is not advisable to remove these for some hours.

The mould is assembled on two or three thicknesses of newspaper laid on the floor of the shed or on a bench, this makes dismantling of the mould easier.

The concrete is placed first around the sides of the mould, taking care thoroughly to fill the corners and edges. It is then filled and levelled off with a wood float or flat piece of wood. Moulds can, of course, be made to produce any size of slab, both in area and thickness, but in the case of slabs of a thickness of 1in or less, the mix should be made in the proportions of one part cement to 2½ parts sand.

Fig. 6 (a, b, c and d) shows how small slabs may be used to form attractive garden edgings. Two very simple forms are shown at a and b. The slabs are about 8in wide and are set in the ground to a depth of 2in, the ground being first consolidated by ramming. The joints between the slabs are bonded by mortar made of one part cement to four parts sand.

A two-course edging is shown at b. The ground is rammed solid and a 1in-thick bedding of one part cement to four parts sand laid and allowed to harden. The slabs are laid on this with the joints staggered as shown.

A more elaborate form of edging for higher beds is indicated at d. The coping slabs are of greater width and slightly thinner section than those used for the walling.

A PRE-AMP FOR XTAL PICKUP

(Continued from Page 75)

Although the .05 meg load resistor has been classified as suitable for standard 78 rpm records, this really only applies to English recordings, most American recording characteristics (and there are several of these) being more like the microgroove characteristic, though differing most in the degree of treble de-emphasis required. Thus it will usually be found that the heavier bass response together with varying degrees of top cut will be more suitable for these records.

The beginner can gain much valuable experience by measuring the response curve of his pickup and amplifier system, and this is not a particularly difficult undertaking. First requirement is a frequency test record, and, although not yet readily available in the microgroove type, is easily obtained from most music stores in the 78 rpm variety.

They are normally made with the same recording characteristic as used by the record manufacturer, so that the output from the amplifier should, ideally, be equal for all frequencies if the circuit is correctly compensated. Even if this is not achieved, an output meter will show where the worst peaks occur and what correction is needed.

OFF THE RECORD — NEWS & REVIEWS

There appears to have been little change on the record front during the last month — the holiday period is mainly responsible for this. From now on however we might expect to see some movement towards the release of new records from old and new companies, and no doubt more imported equipment if the promise of easing import restrictions comes true.

By JOHN MOYLE

SIR ALEXANDER AIKMAN, chairman of directors for EMI, has announced that LP records would be made in Sydney soon but, while this may represent an important statement of policy, it will not of itself set the presses rolling overnight on the new product.

We should see some of the promised Nixa records before long and, I hope, some from Philips.

In addition to their arrangement to handle the American Columbia recordings, there are some very fine Philips records made in Holland by Dutch artists. I had the opportunity of hearing some of these records recently, and was most impressed by them.

TOP QUALITY

One operatic record featuring a Dutch soprano would stand comparison with anything I've heard for all round excellence—very clean, good balance, and presence, low surface noise. Philips won't say at the moment when we can expect to see records from them, but I gathered it would be probably a matter of months.

It will be interesting to see what Philips will do in the matter of standards, for in Europe they have been associated with some unusual records. There were, for instance, the 78 rpm records using the smaller groove, and again 7-inch records at 33 rpm for short numbers.

Frankly I would be surprised to see either of these being issued in Australia at least for some time. No doubt, like other manufacturers, they will be too ofully occupied in overcoming production and sales problems to botner with anything but standard types. I have the impression, however, that the 45 speed isn't as popular with Philips as elsewhere, and my guess would be that their records will be confined to 78 and 33 rpm. Time will tell.

The latest releases of LP's in England by EMI show much the same general tendency as the first list, including re-releases of recordings already well known on 78's. One likely to be popular is the Heifetz recording of the Elgar Violin Concerto—an extraordinary work from any viewpoint, and a vivid contrast with the youthful Menuhin effort which has been in the catalogue for many years now. There is also a popular "Symphonic Variations," by Moura Lympany, one of the best all-round performances there is.

Both HMV and Columbia have made a flying start in building up a repertoire of complete operas. We see the Barber of Seville, Dido and Aeneas, Carmen, The Mastersingers, Tosca and so on, featuring big names such as Gigli, Kirsten Flagstad, Elizabeth Schwarzkopf, and Victoria de los Angeles.

OPERAS POPULAR

The popularity of such recordings isn't really surprising when we remember the large number of music-lovers who are interested in opera, together with the fact that until the LP record came along, operatic recording in full was a hopeless business.

Imagine trying to sit through a Wagnerian opera calling for the best part of a hundred changes of side, as would be needed for the longer works, to say nothing of the disastrous effects such a necessity has on musical continuity. As a result, many people are hearing such operas for the first time on LP records.

Again I'd instance the Mastersingers and La Boheme as examples. It's safe to say that the large majority of listeners has never seen either opera in the flesh, particularly the Wagner. Their acquaintance has been limited of necessity to scattered excerpts sung as solo items. It is something of a shock to meet these at long last in their proper context, an experience which often means a completely new interest in what was previously a threadbare aria. Much orchestral and choral work is new because it wasn't suitable for featuring on single 78 rpm sides.

It seems, therefore, that we can expect an impressive opera list to be built up in the course of time, with inevitably a choice of recordings for each. What an impact these will make on the catalogue!

MULTIPLE SPEAKERS

One or two readers have written to me about my remarks last month on multiple speakers. It would seem that by selecting specific models of different sizes, using them with multiple channels or networks to balance them up and so on, some have managed to get quite good results, assuming the figures quoted to me are correct.

Without buying in to controversy about such individual experience, I think I should point out that my remarks were of a general type meant for consumption by less technical record lovers who aren't up to handling any special technical problems.

In fact, I included a special paragraph in my notes in which I said that, by these or similar methods, it might be possible to achieve some success.

The queries which prompted my original remarks didn't come from technically minded readers, but from those I knew quite well wouldn't have a clue of how to go about it, and would, therefore, only waste their time and money. We all reach a stage in this amplifier game where, for the time at least, we must call a halt, recognise that our outfit is the best we can manage in reference to the present state of the balance-sheet, and decide to enjoy it. I always hesitate to suggest any line of experiment to any given class of listener which I'm not reasonably sure he can follow with success.

ARTHUR CLARKE

We learned with deep regret of the death of Arthur Clarke—EMI's veteran recording engineer, who came to Australia to record the Sydney Symphony Orchestra last year.

A first-class recording engineer is more than a man who watches meters and turns knobs. Arthur Clarke's first records were, in fact, made in the days when there were no knobs to turn, and discs were made purely acoustically. Maybe experience in those years helped to develop his exceptionally keen ear for balance, clarity, the right sound in the right place. Over the years he made records for virtually every celebrity in the EMI lists.

Not only was he a thoroughly competent and experienced recording engineer, but a man with a wealth of gramophone history to speak of, and tales to relate. We might give a thought to him when we listen to the fine discs he helped to make.

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"BETATRON" GIVES RAYS TO ORDER

(Continued from Page 9)

machine which can produce cosmic-y energies in the laboratory, in ɔundance, and with precise control.

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The image cast is so sharp that ıe photographic plate can be placed way from the object, immediately enlarging the picture so much that flaws or spaces up to 1-1000in wide can be seen.

The 24,000,000-volt betatron was chosen for commercial production because it provides maximum industrial results. Lower x-ray energies do not give as great penetration through metal. Higher energies also do not penetrate as well. This paradox results because, beyond 24,000,000 volts, more and more of the energy transforms into minute particles of matter through the phenomenon known as "pair production."

Medical science has the problem of destroying cancers without injuring other tissues. The betatron provides new ways of accomplishing this. It offers reduced danger of damage to healthy tissues, less radiation sickness, and shorter treatment time.

X-rays under 1,000,000-volt energies have their greatest effect on the skin of a patient and on the tissues immediately beneath. Their greatest value is for cancers in this area, since their effect decreases with depth of penetration.

X-rays from a 24,000,000-volt betatron have greater effect at depth than at the surface. The high energy also provides a ray beam with very sharply-defined edges, which is important when a cancer is close to vital organs.

This is important, too, for "cross-firing," which means aiming x-ray beams into a deep cancer from several different angles.

The commercially - produced 24,000,000-volt size of betatron is used medically because it provides sufficient energy without certain disadvantages which might result from using still higher voltages. The first betatron used solely for medical purposes was installed at the University of Illinois College of Medicine in the city of Chicago in 1949. (Science Digest.)

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SHORT-WAVE NOTES BY ART CUSHEN

NEW VERIFICATION CARD FROM VOA

The new verification card being received from the Voice of America, New York 19, New York, gives the type of verification listeners have been looking for a long time, and gives a lead, which we hope some other stations will follow. The card lists the frequency, location, date of reception, listener's name.

THE old card, simply verifying the date of reception of VOA programs, was not technically correct and was not appreciated by most listeners.

Introduced in the recent weekly "Radio Amateur Program" Roger Legge, who is in charge of verifications, and the VOA Frequency Assignment Officer, spoke of the card, which was the answer to many requests for a proper verification. VOA will be pleased to verify any report at New York of the transmissions on the East and West Coast transmitters, as well as the relay stations at Munich, Salonika, Tangier, Manila and Honolulu.

Legge, who is one of the leading US DX-ers, stated that they received over 300 reports each month for verification, and these were mainly from Swedish and New Zealand DX-ers. The latter listeners he complimented on the detailed reports submitted.

VOA request is that when sending reports for verification, listeners list the exact frequency, station call, and date and time in GMT, to make the work in New York easier.

This new verification card, is one of the aims of the NZRDXL, who though not directly given credit for the approach to the VOA for a new card, feel they were indirectly concerned in having a proper verification mailed to DX-ers.

All-India Radio, Radio Pakistan, and Radio Nederlands, are still not verifying in detail, though the latter station will confirm reception by marking the frequency reported on the verif. card.

ONLY 1500 WATTS

IN verifying our report on DZ16, 17805 kcs, of the Far East Broadcasting Co., the transmitter engineer stated this new transmitter was a home-made 1500-watt job, and the present antenna is a half wave. They plan to use a rotary beam antenna for the 16-metre station, as they use at present on DZH8 (15300 kcs). All the transmitters are built by the staff.

The Far East Broadcasting Company, PO Box 2041, Manila, plans to use a new frequency in the 13-metre band, as soon as it is assigned to them, and expect to be operating here in a few months. This will give them a very fine array of transmitters, using the 85, 49, 31, 25, 19, 16 and 13-metre bands.

Present schedule of all these stations is: 7 am, 4.45 pm, 6 pm-3 am, weekdays, and on Sundays from 7 am to 3 am (Monday). Broadcasts are carried in 33 languages and dialects, and the station is "dedicated to the highest Christian, cultural, and moral precepts of life." Transmitters are located outside Manila at Karuhatan, Polo.

CKOB REPORTED

THE use of station CKOB, on 6090 kcs, Montreal, Canada, which has been heard at 5 am in the European Service, has meant a new station to most listeners. Reception on Sundays is clearer, as VL16 does not take the air to 6.45 am. The latest Canadian schedule, effective February 1, shows a shortening on the time used on CKOB. The "Maple Leaf Hour" broadcast from 10.55 pm Saturday, 10.20 pm Sunday, is good on CKLX (15090).

AUSTRALASIA

CKLO (9630), CKNA (5970) 6.45-7.50 pc (Wed. Sunday). CKLO (9630), CKNA (5970) 6.25-6.45 pm (Daily—for later rebroadcast by Radio Australia to Korea).

EUROPE

CKNC (17820), CKLX (15090) 10.20 (Sun.), 10.55 (Sat.), 11.45 pm-12.05 am. CKNC (17820), CKNX (15190) 12.05-2.30 am. CKNC (17820), CKCS (15320) 2.30-4.45 am. HOL (11720), CKLP (9585) 5-7 am. CKLP (9585), CKOB (6090) 7-9.30 am. Note: CKOB may be replaced by CKRZ (6060). CKLP may be replaced by CKLO (9630).

LATIN AMERICA

CHOL (11720), CKLO (9630) 9.50 am-2 pm.

NORTH-WEST TERRITORIES

CKLO (9630), CKOB (6090) 2.25-3 pm (Mon. only).

FROM THE MAILBAG

YUGOSLAVIA—Radio Yugoslavia, PO Box 97, Belgrade, verified with a folding card, one half confirming reception, and the other half, devoted in color to a local scene. Program schedule enclosed shows that English is broadcast 4.30-4.45 pm on 6100, 9500 kcs; 2-2.15 am on 6100, 6165; 4.15-4.30 am on 6100, 6150 kcs; 7.45-8 am on 6100, 6150 kcs.

VENEZUELA — YVOI, Radio Valera, Valera, Venezuela, confirms reception with a white card, giving details of the station, address and controllers. YVOI is located at Avenida Bolivar, No. 52 in Valera.

LATIN AMERICA—On New Year's Day some stations in this area were heard with late broadcasts, and the possibility of hearing something unusual was again offered. Jack Corbett, Brisbane, reports hearing YNWW, 7850 kcs, Radio Sport, in Grenada, Nicaragua. We added YVLK (4970), Caracas "Radio Rumbos," and HC2LB (4550) "Radio America," Guayaquil, HC1BF (4750) Quito, and HC4AS (4436) Esmeraldas, Ecuador, to the log book, all heard around 5 pm.

DIGEST OF DX TIPS

Kcs.	Call and location	Time Heard.
4840	VUB3—Bombay, India.	Hindu programme 1.30am.
6040	ZM2AP—Apia, Samoa.	To test here soon.
6175	Radio Malaya, Singapore.	Chinese news 9.30 pm.
7125	Hollandia, Dutch New Guinea.	Request session Tues. 8.30 pm.
11765	ZYB8—Sao Paulo, Brazil.	Opens 7.00 pm.
15120	Warsaw, Poland.	English news 10.15 pm.
15430	France Asie—Saigon.	Mailbox session, Fri. 7.15 pm.
17790	VLB17—Melbourne.	Mon.-Fri. 12.55-2.15 pm.
17820	Radio Ceylon, Colombo.	Fair at 7.30 pm.
17890	HCJB, Quito, Ecuador	To Europe, fair 8 am.

FLASHES FROM EVERYWHERE

PAKISTAN.—Radio Pakistan has be logged on a new frequency of 3325 k with English news relayed from the Ho Service at 1.15 am. This frequency assigned to Peshawar, but as this sho wave station is not yet in operation, frequency is being used by Dacca. Laho using 3465 kcs, has also been heard of English broadcasts is listed below: the same time.

INDIA—Delhi broadcasting in Ara from 2.30 to 3.30 pm daily, uses two n frequencies, 11940 and 15085, both ceived at good strength. Radio Srina in Kashmir has been noted on 3175 at 1.30 am with the usual relay of E lish news from Delhi, but morse troublesome.

ENGLAND—Rex Gillett, of Adelai informs us that he is hearing the B on a new frequency of 17890 kcs at 9 pm when they relay the General Ov seas service. He mentioned that G (21540) opens at 10.30 pm with a progr in Urdu, relayed from the Voice America, this transmission also be heard on Tangier-9, on 21690 kcs.

POLAND—Rex passes on the tip t Warsaw on 15120 kcs is fair at 10.15 with an English program to No America. Warsaw, is also using seve new frequencies, and the present sched of English broadcasts is listed below:

TO EUROPE

4.30 pm-5 pm on 5955, 5995, 7125 k 3-3.30 am on 7175, 9555 kcs. 3.30-4 am 6025, 7145, 9555. 5-5.30 am on 6025, 71 9555. 5.30-5.55 am on 5995, 5975, 71 8.30-9 am on 5955, 5975, 7125.

TO NORTH AMERICA

9-9.30 pm on 9570, 9555. 10.15-11 pm 15120, 9555. 8.15-9 am on 6025, 9555. 10. 11.15 am on 6025, 9555. 2.15-2.45 pm 6025, 9555. 3.30-4 pm on 6025, 9555.

NEWS of DX items heard by readers would be appreciated. Send your comments to Arthur Cushen, 212 Earn St., Invercargill, New Zealand. Closing date for the next issue is February 7.

CEYLON—Wally Anderson, Paddingt NSW, reports good signals from the Co mercial Service of Radio Ceylon, on 17 kcs, at 7.15 pm. The Commercial Serv has been noted as early as 3.30 pm this frequency, while the 15120 kcs o let has been relaying the Cricket Te from Radio Australia, the 17820 kcs stati has been carrying the usual commerc programs.

MOZAMBIQUE—Jack Corbett repo good signals from the Radio Club Mozambique, at Laurenco Marques, w the English commercial programs South African listeners on 11955 kcs sign off at 6 am or 6.15 am.

RADIO MALAYA

The Green Network (Chinese) of Ra Malaya, Singapore, is using a new f quency, 6175 kcs for the broadcasts fr 7.30 pm to 1.30 am. This station w formerly on 7250 kcs, with 5000w. T two other networks operate as follow Blue Network (English, Malay) Mon.-F noon-4.30 pm, 7.30 pm-1 am, Saturd noon-2 am, Sunday 11.30 am-1.30 am, 7200 kcs, 5000w and Kuala Lumpur 6 kcs, 5000w. Red Network (Indian, Mal Chinese), 2-4.30 pm, 7.30-12.30 am on 6 kcs, 5000w, also some periods on Ku Lumpur (6025), according to World Ra Handbook.

Notes for the March issue close February 7, April issue on March at 212 Earn St., Invercargill, NZ. times used on this page are Easte Australian Time.

THE HAM BANDS WITH BILL MOORE

Emergency operation of amateur radio stations has in the past supplied a service while normal communication facilities were being restored. The following proposed scheme will be another method by which amateurs can assist in times of flood and fire

SOME 12 months ago, the fact was publicised that the NSW police department would sponsor a scheme in which radio amateurs on the North Coast could operate during emergencies on police frequencies close to the 3.5 and 7 Mc amateur bands.

The police department would make available suitable crystals for these frequencies, and these would be held normally by the local police, who would issue them in time of emergency. A number of these crystals are now available and it is anticipated that the order will be filled by the end of this month. The program of operation will then be arranged, xtals allocated, and tests conducted.

Since the original announcement, one crystal frequency has been changed, 3245 Kc/s has been varied to 3252 Kc/s. The other frequency remains as before, 6915 Kc/s. The whole scheme centres around arrangements made in 1950, by which the police department would be the responsible authority for the origination of all messages requesting relief, supplies, and the issuing of flood warnings.

This arrangement should eliminate any possible duplication of messages calling for relief which had been experienced previously.

The amateur stations operating on police frequencies would contact either radio station VKG, Sydney, or VKG3, Newcastle.

A continuous watch is kept on the two frequencies, and 150 watt transmitters are located at both centres. Receivers are crystal locked and remotely controlled. In view of the latter fact, all transmitters operating will be crystal controlled, the department, as mentioned previously, supplying the crystals.

The army and RAAF will also operate on the two frequencies during emergencies, with the ducks and aircraft both using crystal controlled transmitters on 3252 and 6915 Kc/s.

Two sets of xtals have already been issued to two vulnerable positions, one set is held by Crieff Rettalick, VK2XO, at Raleigh, and the second by the Kempsey police.

Sergeant Bert Glasscock, VK2ZI, officer-in-charge of the NSW police wireless section, is working on the final details of sets and procedure, and it is hoped to run the initial trials within the next two months. It is anticipated many amateurs will co-operate.

50 Mc. CONTEST

PROPAGATION conditions during the Ross A. Hull Memorial Trophy contest run exclusively on the 50 Mc band) were poor compared with those experienced in previous years. It was disappointing for the UHF gang who waited patiently for the usual good portion of Sporadic E that is usually around during the Christmas holidays.

Best DX for the test were Doug, VK9DB and Frank, VK9FN, who came on the band especially for the contest.

Stations in some States appeared to be more fortunate than others with the number of openings that occurred. NSW stations, for instance, are dependant on New Zealand openings in order to build up reasonable totals, but only a few poor openings took place.

Of the stations participating, VK4BT was scoring very well and should be well up in the list of final results. VK5QR, MK, 5HD and 5BC scored well also, while VK2WJ and 2WH amassed good totals.

VR2CG, VR2CB and ZK2AA were active during the contest and they are believed to have contacted some North Island ZL stations.

The total number of stations active appeared to be less than last year and several competitors thought a change of times away from the holiday period might be an advantage — it would certainly allow the family to obtain more attention. It is doubtful whether as many stations would be able to compete unless the operating periods were restricted to weekends.

New Zealand stations were competing for the H. P. V. Brown Cup. Interest in the contest has been so keen in NZ that the NZART decided to arrange a suitable trophy for the event for its own members.

EMERGENCY NETS

A NUMBER of English amateurs for some time now have been considering forming an amateur emergency communications network on similar lines to other countries. The RSGB was approached by one amateur and they pointed out the problems of such operations.

The council stated, that the society had received information that the government's communications requirement in the event of an emergency arising are now fully provided for with standardised equipment. In the view of the council, the best contribution public-spirited amateurs can make to the national problem of providing emergency communication, is for them to offer their services to the Civil Defence or Home Guard authorities.

HUNTER BRANCH

THE January meeting of the Hunter branch of the WIA was held on January 9, when branch president Lionel Swain, VK2CS, lectured on his latest effort, a 6-band switched transmitter The equipment is a very useful transmitter for rapid band changing. John Moyle, VK2JU, divisional president, attended the meeting.

Special arrangements have been made for the February meeting of the branch, which will be held at Technical College, Tighes Hill, Newcastle, on Saturday, February 14. The UHF section of the NSW division will demonstrate and lecture on the UHF's and suitable equipment for use down there. Members will journey up from Sydney, taking with them equipment for display. The evening should not be missed, as the Sydney members of the division, who saw a similar display late in 1952, were very impressed. The equipment on display is finely constructed and along the latest lines in UHF practice.

RSGB ACTIVITIES

ORGANISATION of the International Amateur Radio Union Region, the (Europe) Bureau has been left to the RSGB and the committee met on a number of occasions during the past year.

The first issue of the region, the Bureau News has been forwarded to European member societies and general comment from these societies is gratifying.

It is very important with the world divided into three regions for frequency allocation purposes, that all societies in any region should have full information on the decisions of the various administrations. This would then allow national societies to take any action should it be considered that any nations are infringing on the agreed allocations.

FINANCES

The RSGB has experienced similar financial dicicculties to other amateur radio societies in other parts of the world. It is certain that they will by June raise their annual subscriptions from the current rates that have not been changed for 20 years.

The last year of operation showed a loss of £2143, making a serious inroad into assets.

The main contributing factor has been the increasing cost of their monthly journal, the RSGB Bulletin, which is issued free to members and has no great bookstall sales. "Amateur Radio" costs have increased rapidly here, too, and present a serious problem, especially to the Victorian division, who publish the journal.

The total membership has dropped from 14,439 in the peak year 1948, to 11,625 in 1952, an expected decline.

This last figure is still well in advance of the prewar peak of 3500. Officials blame the present unsettled economic state of the country as the factor chiefly responsible for the decline in membership in most hobby-interest organisations.

The ARRL seems to be the only society with no serious financial problems, as the flourishing publishing side of the organisation must provide a substantial income to offset any losses suffered in running the general organisation.

The WIA itself, is in an even worse position than most other societies. This is due to the necessity and additional cost of running both Federal and State organisations. There seems to be no ready solution to these problems.

SUPPORT FOR NATIONAL FIELD DAYS

NATIONAL field days are popular events in most countries, especially in Europe. The WIA's event run annually on the Australia Day weekend in January is just over, but never receives anything like the support afforded similar days overseas.

The RSGB has recently rearranged the rules for their field days and the general impression is that they now offer opportunity to amateurs with quite simple equipment.

Most interesting points included in the RSGB rules are as follows:—

The contest runs for 24 hours from 6 pm, Saturday, to 6 pm, Sunday. The field day covers stations operating under the following prefixes: G, GC, GD, GI, GM and GW, and all entrants must be fully paid up members of the RSGB.

Only properly constituted RSGB town or area groups may enter stations and permission to operate is granted by the local RSGB representative.

Each group is permitted to enter two stations (A and B), "A" stations may operate on 1.7 and 3.5 Mc/s or 1.7 and 7 Mc/s, while "B" stations may operate on 7 and 14 Mc/s or 3.5 and 14 Mc/s. Each station must use a different call.

Stations must be operated from tents and no equipment (tents or radio gear) may be set up prior to five hours before the commencement of the contest.

Only three aerials may be used (including receiving antenna) by each station. Other limiting factors are as follows:—All aerials and feeders must be constructed from wire of total cross sectional area not greater than 14 SWG, they shall not be erected at a greater height than 45ft above ground.

Equipment for either "A" or "B" stations shall not exceed two transmitters and one receiver. Reserve equipment may be taken out in the field but must not be connected to power supplies.

The total DC input to the anode circuit of the valve or valves energising the aerial, or to any previous stage, shall not exceed 5 watts.

Power for any part of the station equipment shall not be derived from supply mains. The general rules are similar to normal contests.

The rules generally, restrict operation in an endeavor to equalise the opportunities of all entrants — 5 watts input allows operators to use simple equipment and a smal source of power, while the limit on wire size for antennas rules out the use of many types of beams. The event is always extremely well supported in Great Britain and is the most popular run during the year.

STANDARD -FERGUSON- RANGE

RECEIVER POWER TRANSFORMERS

CODE No.	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS	RETAIL PRICE
PF185	240	150	30	6.3V/2A	43/11
PF299	240	285	40	6.3V/2A, 5V/2A	43/11
PF300	240	325	40	6.3V/2A, 5V/2A	45/6
PF201	240	225	50	6.3V/2A	44/8
PF151	200, 230, 240	285	60	6.3V/2A, 5V/2A	53/1
PF166	200, 230, 240	325	60	6.3V/2A, 5V/2A	54/-
PF165	200, 230, 240	385	60	6.3V/2A, 5V/2A	58/3
PF170	200, 230, 240	285	80	6.3V/2A, 6.3V/2A, 5V/2A	60/10
PF169	200, 230, 240	325	80	6.3V/2A, 6.3V/2A, 5V/2A	62/4
PF168	200, 230, 240	385	80	6.3V/2A, 6.3V/2A, 5V/2A	65/5
PF130	200, 230, 240	285	100	6.3VCT/2A, 6.3V/2A, 5V/2A	67/6
PF164	200, 230, 240	325	100	6.3VCT/2A, 6.3V/2A, 5V/2A	69/-
PF160	200, 230, 240	385	100	6.3VCT/2.5A, 6.3V/2A 5V/2A	76/5
PF152	200, 230, 240	285	125	6.3VCT/3A, 6.3V/2A, 5V/2A	85/4
PF163	200, 230, 240	325	125	6.3VCT/2.5A, 6.3V/2A, 5V/2A	86/10
PF181	200, 230, 240	385	125	6.3VCT/3A, 6.3V/3A, 5V/2A	95/8
PF174	200, 230, 240	285	150	6.3VCT/2A, 6.3V/2A, 5V/2A	89/8
PF142	200, 230, 240	325	150	6.3VCT/2A, 6.3V/2A, 5V/3A	96/7
PF175	200, 230, 240	385	150	6.3VCT/2A, 6.3V/2A, 5V/3A	111/11
PF173	200, 230, 240	425	175	6.3VCT/3A, 6.3V/2A, 5V/3A	173/3
PF140	200, 230, 240	385	200	6.3VCT/3A, 6.3V/3A, 5V/3A	162/2
PF171	200, 230, 240	385	250	6.3VCT/4A, 6.3V/3A, 5V/3A	213/3

POWER AMP. AND LOW POWER TRANSMITTER UNITS

PF159	220, 240, 260	475	175	6.3V/4A, 6.3V/2A, 5V/3A	188/9
PF172	200, 230, 240	500	200	6.3V/4A, 6.3V/3A, 5V/3A	213/3
PF143	200, 230, 240	600 500	200	2.5V/5A, 2.5V/5A, 5.6V/5A	236/1
PF147	200, 230 240, 260	1000 750 500	200 250 300	5.5V/.3A	292/10
PF179	200,230, 240	475	225	6.3VCT/4A, 6.3V/2A, 5V/3A	183/1
PF107	230, 240	585	250	6.3V/3A, 6.3V/2.5A, 5V/3A	224/10
PF176	200, 230, 240, 260	1250	300	6V/.3	449/9
PF177	200, 230, 240, 260	1830, 1100	300	6V/.3A	Price on request

VIBRATOR AND A.C. POWER TRANSFORMERS

PF182	240AC 12V1B	200	40	12.6V/1A	53/10
PF122	240AC 6V1B	220	40	6.3V/2A	54/-
PF125	240AC 6V1B	250	60	6.3V/2A	63/-
PF126	240AC 12V1B	250	60	12.6VCT/1A	63/-
PF119	240AC 6V1B	325	125	6.3V/4A	89/10
PF146	200, 230, 240 AC, 12, V1B	325	150	12.6VCT/2.5A	105/9

VIBRATOR TRANSFORMERS

CODE NR	PRIM. VOLTS	DC OUTPUT VOLTS	mA	BUFFER Full Sec.		RETAIL PRICE
VT100	32	200	40	.005		44/6
VT101	6	90	15	.008		34/10
VT102	6	150	25	.005		40/9
VT103	6	200	50	.005		42/11
VT104	6	250	60	.005		43/11
VT105	12	250	60	.005		45/6
VT106	6	300	75	.008		72/7
VT107	6	250	60	.005	Low Radiation	48/1
VT108	12	90	15	.008		36/3
VT109	24	90	15	.008		38/4
VT110	12	150	25	.005		42/11
VT111	24	150	25	005		47/-
VT112	12	200	50	.005		45/-
VT113	24	200	50	.005		45/-
VT114	12	300	75	.008		78/2
VT115	24	300	75	.008		79/-
VT116	24	250	60	.005		50/1
VT117	12	250	60	005	Low Radiation	48/6
VT119	32	150	25	.005		40/8
VT121	6	180	30	005		45/-
VT122	6	400	50	.005		73/4
VT123	12	320	125	.005		94/5
VT124	32	250	60	.005		49/1
VT127	6	200	50	.005	Low Radiation	45/-
VT128	12	250	60	.005	Low Radiation	53/1
VT146	6 or 12	240AC	50W	1MFD.	For emergency light, etc.	64/2

POWER CHOKES

CODE No.	IND HY.	DC RES	DC mA	RETAIL PRICE
CF100	50	1900	10	29/6
CF101	30	870	25	28/9
CF102	15	300	60	22/5
CF103	30	420	60	42/2
CF104	30	580	75	44/10
CF105	15	250	80	37/9
CF106	12	200	100	38/2
CF107	30	360	100	51/9
CF108	12	135	150	53/11
CF109	20	225	150	56/4
CF110	12	100	200	65/5
CF111	16	165	200	65/5
CF112	10	70	250	65/5
CF113	.5/20	70	250 50	72/1
CF114	1.1	23	375 AC	44/10
CF115	.017	.6	2A	19/8

GRID INPUT TRANSFORMERS

CODE No.	MATCHING FROM	TO	NOM. IMPEDANCE PRIM.	SEC.	MAX. WATTS	RETAIL PRICE
MT104	Mike, P.U.	Grid	3.7, 50	50,000		44/10
MT105	Mike, P.U	Grid	3.7, 50	60,000		164/1
MT108	Line	Grid	120	1200		98/11
MT109	Cath.	Grid	100	1000		56/2

LINE TRANSFORMERS

MT100	Line	Spkr.	600	4, 3	15	56/2
MT101	Line	Spkr.	500	15	15	56/2
MT124	Line	Spkr.	600 500	4, 3, 2.7 2.3, 2.	25	94/5
MT125	Line	Spkr.	600 500	15, 12.5 8.4, 6.5	25	92/2
MT111	Line	Spkr.	500	12.5, 8 2.3	10	60/7

MODULATION TRANSFORMERS

MT118	Audio Amp	Class C Amp	8000 6000 P.P.	10,000 7000 5000	25	148/6
MT119	Audio Amp	Class C Amp	8000 6600 3800 P.P.	10,000 7500 6500 5500 4500 3500	60	171/-
MT120	Audio Amp	Class C Amp	500 to 20,000 in steps	500 to 30,000 in steps	50	312/7
MT121	Audio Amp	Class C Amp	500 to 20,000 in steps	500 to 30,000 in steps	125	384/10

DRIVER TRANSFORMERS

MT106	Class A Driver S.E.	Class AB1 Grids	5000 Step Up 1:5 Pri DC 40 mA	125,000	6	98/-
MT107	Class A Driver HI. MU. S.E.	Class A Grids P.P. or S.E.	10,000 Step Up 1:3	90,000	1	143/-
MT112	Class A Driver HI. MU S.E.	Class A Grids P.P. or S.E.	10,000 Step Up 1:2 5 mA DC unbalance.	40,000	.5	89/11
MT113	Class A Driver S.E.	Class AB2 Grids	5000 Step Down 1.25:1 40 mA Pri. DC	3200	2	106/11
MT114	Class A Driver P.P	Class B Grids	5000 Step Down 1, 1.5 or 2	5000 2200 1250	5	122/7
MT115	Class A Driver P.P. or S.E.	Class B Grids	5000 Step Down 1.07 or 1.4 40mA DC max unb.	4400 2500	5	122/7

FILAMENT TRANSFORMERS

CODE No.	PRIM. VOLTS	SEC VOLTS	RETAIL PRICE
PF117	240	2.5V/.3A.	29/1
PF118	220, 240, 260	2.5V/5A 2.5V/5A.	50/9
PF158	220, 240, 260	5V/8A.	56/2
PF138	220, 240	6.3V/4A, 5V/4A, 2.5V/4A, 2.5V/4A.	79/9
PF162	240	6.3V/3A, 6.3V/3A.	58/8
PF154	200, 230, 240	7V tap 6V/7A. 6.3V/3A. 5VCT/5A. 5V/3A. 2.5V/7A	168/8
PF102	240	7.5V/2A.	42/8
PF111	240	10V/5A	60/4
PF131	230, 240	10VCT/10A, 5V/15A.	179/11

ENGINEERED TO-DAY FOR TO-MORROW'S REQUIREMENTS

DX AND PERSONAL

LATEST move in DX circles is to separate Oman from Trucial Omal. A number of MP4's have been operating from the latter country while VS9AW has been operating from Oman proper. His QTH is c/- RAF Station, Salalah, Aden Command.

Callsign blocks for some of the most interesting Pacific islands have been allocated as follows:—

KG6SA-KG6SZ Saipan, KG6TA-KG6TZ Tinian, KC6AA-KC6ZZ Carolines, and KX6NA-KX6XX Marshalls.

The leader in ARRL'S DX Century Club should reach the 250 mark in the Open section before the end of 1952.

W1FH is still leading and has been in that position for a number of years. His tally is 249 countries; W8HGW is second with 245. G2PL with 241 countries is the only station outside the US in the first ten—who said power didn't count!

W1FH is also the leader in the Telephony section with 221 countries confirmed, PY2CK second 216, then VQ4ERR 215 and XE1AC 213.

These leading stations put in many hours listening, they are seldom heard normally, but if a rare station pops up one of them is certain to come through on a dead band and call him.

A rare one is FB8BE, who usually is on sked with FB8ZZ, is at good strength around 0030 hrs EAST, 14050 kc/s. His full QTH is Pierre Reyter, FB8BE, Tamatave, Madagascar.

SU1HS is operating under cover along the Suez Canal and would appreciate cards via the RSGB. Dave's old call was AP5B, and has been S7, 14015 kc/s at 2300 hrs EAST.

The bands currently available to British amateurs, are as listed below. Shown, too, is the maximum power allowable as well as the types of emissions permitted.

Normally operation is restricted during the first year of transmitting to an input of 25 watts and licensees are permitted to use CW only on all frequencies below 420 Mc/s.

Listed in order are frequency in Mc/s, maximum DC input (watts) permitted and, finally, types of emission.

1.715-2.0-10-A1, A2, A3, A3a.
3.5-3.635-150-A1, A2, A3, A3a.
3.685-3.8-150-A1, A2, A3, A3a.
7.0-7.3150-A1, A2, A3, A3a.
14.0-14.35-150-A1, A2, A3, A3a.
21.0-21.45-150-A1, A2, A3, A3a.
28.0-30.0-150-A1, A2, A3, A3a, F1, F2, F3.
144-146-150-A1, A2, A3, A3a.
144.5-145.5-150-F1, F2, F3.
420-460-150-A1, A2, A3, A3a, F1, F2, F3.
425-455-150-A5 and F5.
1215-1300-150-A1, A2, A3, A3a, F1, F2, F3.
1225-1290-150-A5 and F5.
2300-2450-150-A1, A2, A3, A3a, A5, F1, F2, F3, F5.
2350-2400-25 mean and 2.5 Kw peak — P1, P2d, P2e, P3d, P3e.
5650-5850-150-A1, A2, A3, A3a, A5, F1, F2, F3, F5.
5700-5800-25 mean and 2.5 Kw peak-P1, P2d, P2e, P3d, P3e.
10,000-10,500-150-A1, A2, A3, A3a, A5, F1, F2, F3, F5.
10,050-10.450-25 mean and 2.5 Kw peak—P1, P2d, P2e, P3d, P3e.

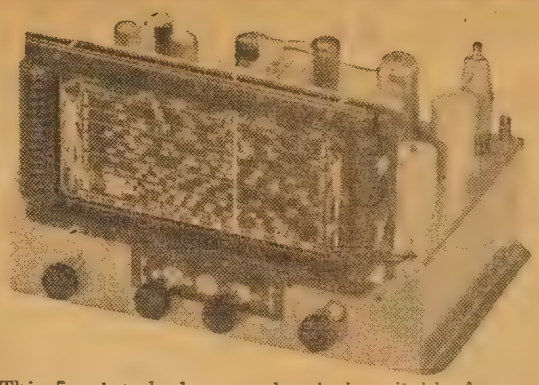
Transmissions in the 144 Mc band are permitted provided there is no interference caused to Government services. 21 Mc, 420 Mc and 1215 Mc band transmissions are permitted, provided there is no interference caused to other services i nthese bands. Under a 10 watt DC input licence peak power for pulse transmissions is limited to 1 Kw.

For A5 transmissions an additional amateur (vision) licence is required at £3 pa for television. The allocation on 7Mc as shown, 7.0 to 7.3 Mc/s, is not in agreement with previous figures on Atlantic City allocations for Region 1 that were available. Further information may come to hand on this point.

YOUR OPPORTUNITY

to join the world-wide ranks of amateur transmitters! The Wireless Institute of Australia holds regular classes in Sydney to assist Sydney and suburban enthusiasts to obtain their Amateur Operators Certificates of Proficiency.

Write for particulars to the Class Manager, W.I.A., Box 1734, G.P.O., Sydney.

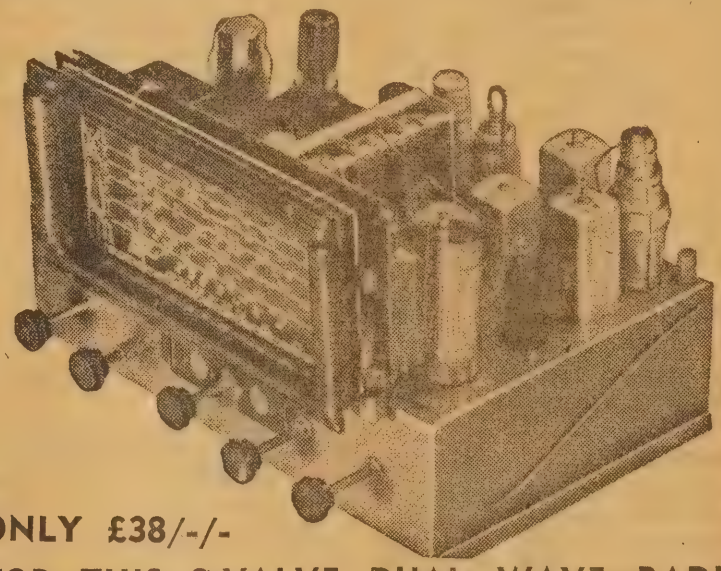


5 VALVE DUAL WAVE RADIO CHASSIS

Complete with 8" speaker and five valves.

£25/-/-

This 5-valve dual wave chassis is suitable for use in a radiogram, and is fitted with pick-up terminals ready to be attached to a record player. It can be used with either magnetic or crystal pick-ups, and is supplied complete with escutcheon plate for the large, edge-lit, clearly marked dial. Price £25/-/-. Size 15" x 10" x 9½" high. Valves used: ECH33B, 6SK7G, 6SQ7G, 6V6G, 5Y3G. Supplied with 12" speaker in lieu of the 8", £26/-/-.



ONLY £38/-/-

FOR THIS 8-VALVE DUAL WAVE RADIO

Here's value only to be found at Radio House Pty. Ltd. This ready-made and tested chassis is complete with valves and 12" permagnetic speaker. Complete in every detail, it's easily fitted into your radio or radiogram cabinet and can be supplied with a polished wood front panel. Ideal for overseas reception, fitted with phono pickup terminals, and has two separate tone controls for treble and bass boost. Size 16" x 10½" x 9" high.

SOUND AMPLIFIERS

For Phonograph Pick-up and Microphone

240 volt A.C. models complete ready for use (without cabinet, microphone or pick-up).

3 valve with 8" speaker .. £12/17/6 (suitable for phono pick-up only 3 watt output). 12" speaker £1 extra.

4 valve midget with 8" speaker £13/15/- (suitable for phono pick-up and microphone 4 watt output). 12" speaker £1 extra.

5 valve with 12" speaker £21/10/- (suitable for phono pick-up only 8 watt output).

6 valve with 12" speaker £25/-/- (suitable for phono pick-up and microphone 12 watt output).

SPECIAL MODELS MADE TO ORDER

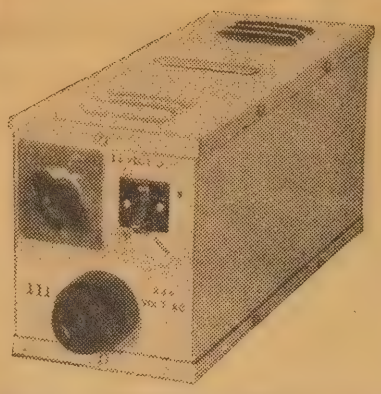
6 volt battery operated 3 valve and vibrator with 8" speaker £18/10/- (suitable for phono pick-up and microphone 4 watt).

RADIO HOUSE PTY. LTD.

296 PITT STREET, SYDNEY.

240 VOLT AC 50 CYCLE INVERTERS

FROM 12 VOLT BATTERY



Suitable for loads up to 200 watts. Excellent frequency stability. Radio interference suppressed. 3 pin power outlet socket.

Price £28/10/-

Suitable for emergency lighting or in conjunction with Radios, Radiograms, Portable Amplifiers, Tape Recorders, Synchronous Motors. Completely shielded in metal case 5 x 6¼ x 13 inches. Unpacked weight 19lb. TRADE INQUIRIES INVITED.

Also available 32 Volt DC to 240 Volt AC 50 cycle at 100 Watts Suitable for Radiograms. Price £28/10/-.

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48-hour jewelled movement. Can be run continuously or for one minute periods. Ideal for photographers, hobbyists, electrical flashes, signs, &c. **22/6**
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0-20mA DC 2½ inch Square Flush English Hobut. Brand new 25/-
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0-30 mA 3 inch Round 25/-
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Scale Size — 14in. Dia. Brand New.

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2mfd	2000vw	20/-	0.25mfd	3000vw	7/6
2mfd	1800vw	20/-	0.25mfd	1000vw	2/6
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1mfd	2000vw	10/-	0.01mfd	5000vw	4/-

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1000mfd	12PV	3/-	50mfd	50PV	2/-
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BUTTERFLY CONDENSERS
Capacitance range 3-35 microfarad. Size 1¼ x 2¼ x 2¼ inches. Brass plates: Ultra high frequency insulation: ¼-inch shaft.
Price, each **8/6**
Packing and postage, NSW, 1/-; Q., T. and V., 1/6; WA, NT, 2/-.

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New Midget Variable Condensers, 19 plate ceramic insulation.
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954	10/-	EA50	5/-
956	12/6	VT90	
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NEW VALVES

1K5	5/-	7A6	10/-
3Q4	12/6	7C7	11/6
3S4	12/6	879/2x2	15/-
6C8G	12/6	1293	11/6
6H6	10/-	1294	11/6
6J5G	10/-	VR54/EB34	5/-
6SQ7	12/6	VR65A	3/9
6x5GT	12/6	EF50	9/-
7193	3/6		

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PRICE, each **£19/10/-**
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We do not accept responsibility for any order damaged in transit.

A SIMPLE PHOTOGRAPHIC ENLARGER

Want to make some enlargements? In case you imagine that it cannot be done without a lot of expensive equipment, we are reproducing details of a simple enlarger which any enthusiast should be able to construct for a few shillings. Simple though it is it should still be capable of good results.

ALL beginners in photography look forward to the time when hey will possess an enlarger, since t is very difficult to make impress-ve pictures without this facility. Un-ortunately, good enlargers are not heap and many fellows find that he outlay required for a good amera—which really needs an en-arger to do it justice—is such that n enlarger cannot be considered or the time being.

In these circumstances many con-ider the possibility of constructing heir own, but, here again, there re problems. While the theory of he enlarger is not difficult (Radio nd Hobbies, December, 1951), the aking of a practical instrument is ot so easy. The main difficulty ; that of making the whole assem-ly completely rigid, optically accu-ate and square, and, at the same me, easy to operate with smooth orking adjustments free from acklash or any tendency to jam.

XPERIENCE NECESSARY

This is not to say that the con-ruction of a good enlarger is be-ond the amateur, but it does mean hat a fair amount of experience in etal work is essential and that the orker should have a reasonably ell equipped workshop. If possible, ne should have access to a lathe, hough this is not absolutely essen-al.

On the other hand, some very nteresting experiments and surpris-ngly good results are possible with xtremely simple—even crude—ome-made equipment, if one is repared to go to a little trouble. dmittedly such set-ups lack most f the convenience associated with properly designed unit and one is ot likely to establish any speed re-ords with them, but they do per-nit the beginner to break into this hase of his hobby for virtually no utlay.

USEFUL EXPERIMENT

There is also no doubt that the xperience gained is extremely valu-ble, particularly for those who are onsidering building more elabor-te versions at a later date, be-ause the optical principles involv-d, and the mechanical requirements, re demonstrated in a manner which is difficult to reproduce in the ritten word, at least with the orce which a practical demonstra-on can provide.

The set up about to be described as been sent to us by a contribu-r, Mr. C. W. Jones, of Gladesville, SW, who claims that, in spite of s simplicity, it is capable of giv-g very good results.

Basically, the idea is to provide lamp house and negative carrier hich can be used in conjunction with the existing camera; while the rather complicated vertical construction is abandoned in favor of the slightly less convenient, but very much simpler, horizontal construction.

From here on we will let Mr. Jones tell the story in his own words:

The original apparatus was constructed from a wooden box measuring 6in x 6in x 9in, preferably with a hinged lid; a baseboard, 8in x 18in x 1in; lampholder and globe, power flex, a few lengths of 1in square wooden beading, a piece of stiff cardboard, short lengths of felt, a sheet of flashed opal glass, two ¼in strips of spring brass and an ordinary box camera.

The main details of the construction can be seen from the diagrams, but a few points may require some explanation.

The air vents are ¾in wide slots cut in the top and bottom of each side of the box. Over these slots, on the inside of the box, are fastened 1½in wide strips of thin wood or metal, fastened at each end, and separated from the side by about ¼in to allow the free passage of air. Small blocks of wood may be used to maintain this separation.

In one end of the box is cut a hole to accommodate the lamp-holder and in the opposite end a rectangular hole ¼in longer and ¼in wider

CAMERA BARGAINS

BUY WITH CONFIDENCE A C. T. LORENZ GUARANTEED USED CAMERA

2¼sq Reflex Korelle, f3.5 Schneider Radionar and f4.5 13.5cm tele Xenar, complete outfit with case £80/-/-

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Kine Exakta f2 Biotar with E.R. Case, £89/-/-

f5.5 25cm tele lens for Kine Exakta . . £30/-/-

10cm coated Canon tele lens, also fits Leica, coupled with optical viewfinder and case, £29/10/-

35mm Canon f3.5 coated Nikkor, E.R. Case, £45/-/-

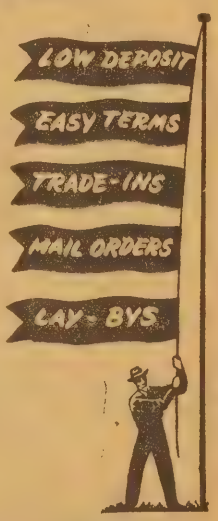
Leica 111c f2 Summitar lens in exquisite condition . . . £122/10/-

35mm Retina 11, coated f2 Xennon, E.R. Case, £45/-/-

3½ x 2½ Super Ikonta f4.5 Tessar, E.R. Case, £42/-/-

Pelcomat 35mm automatic focusing enlarger, f3.5 coated Ross Resolux lens £49/10/-

Rangefinder Bessa 11, f3.5 Skopar with case, £34/-/-



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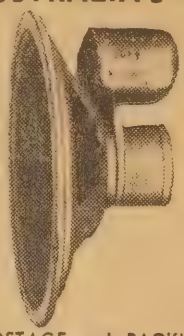

POSTAGE and PACKING

	NSW	Interstate
12" SPEAKERS	7/6	12/6
8" SPEAKERS	5/6	9/6
6" SPEAKERS	5/-	8/6
TRANSFORMERS	1/6	

12" SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 5000 OR 10,000 C.T. TRANSFORMER **54/-**

WITH 15,000 OR 20,000 TRANSFORMER 50/-

8" SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 20,000 OHM C.T. TRANSFORMER **34/-**

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Separate Transformers to suit any of above speakers—5000 or 7000 ohm 8/6 each. (Supplied with speakers only.)

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NEW COLLARO 504 RECORD PLAYERS WITH CRYSTAL OR MAGNETIC PICKUP AND AUTOMATIC STOP .. .. .. **87/6** PLUS FREIGHT

NEW PLESSY RECORD PLAYERS WITH MAGNETIC PICK UP AND AUTOMATIC STOP FITTED WITH PRESS BUTTON SELECTOR . **87/6** PLUS FREIGHT

Leatherette-covered or veneered and polished cases to suit above 57/6. Plus freight.

NEW LUCAS ENGLISH GENEMOTORS

Input 12V. Output 250V at 65Ma
Supplied with input filter.

£2/10/0 Postage N.S.W. 6/6 Interstate 8/9

FOUR VALVE AMPLIFIER

American amplifier complete with two 7C5, one 7F7 and one 7Y4 valves in brocaded aluminium case. (No power supply.)

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Well-known make of carbon potentiometer with switch available in 1 meg, ½ meg or 100,000 ohms at 6/6.
EACH PLUS 9d POSTAGE

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Kits for trickle charger as described in R & H, June issue. Comprising transformer with 18V winding tapped at 12V—3 100Ma rectifiers and 50 ohm control. **39/6**

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TRANSFORMER SPECIAL

New 125 mill power transformers. 240V Prim. 385/385 Sec at 125 mill Two 6.3 and 5V fill windings.
STANDARD LAMINATIONS. Weight 8lb.

37/6

POSTAGE N.S.W. 7/6, INTERSTATE 9/6.

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PLUS FREIGHT
BY PASS. TRAIN ONLY

I.F.F. CHASSIS

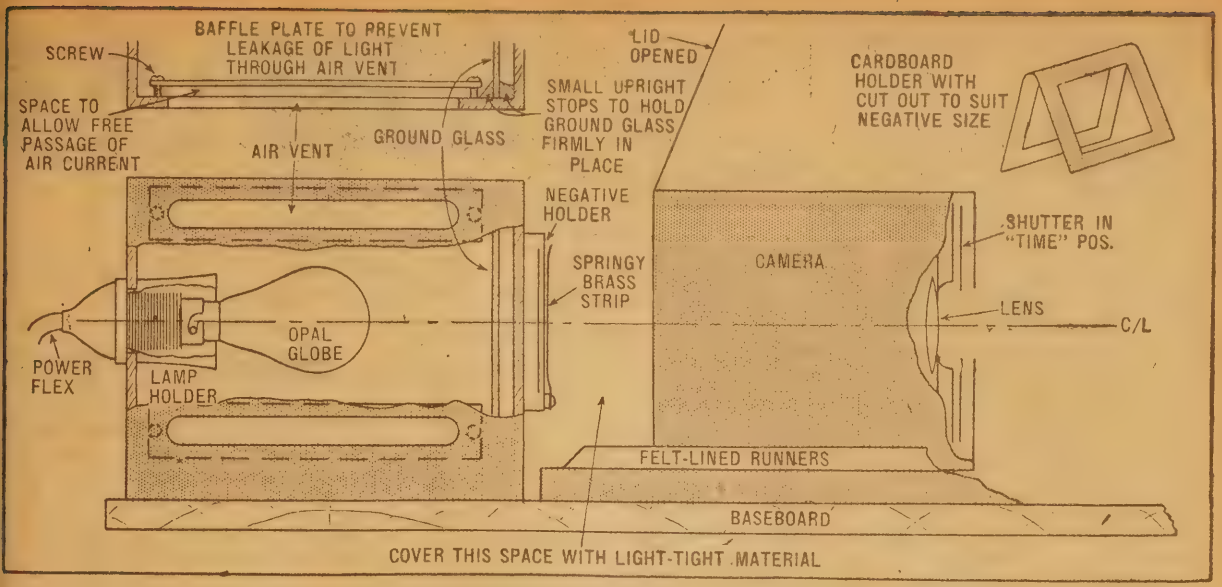
CONTAINING ALUMINIUM CASE

H.F. Oscillator, frequency approx. 200 m/c complete with two 7193 valves. I.F. transformer. 10 high insulation octal sockets, 45 insulated carbon resistors, mainly 2 watt. 24 paper and mica condensers.

METROPOLITAN RADIO SUPPLIES

479 PARRAMATTA RD., LEICHHARDT, N.S.W. PHONE LM3610

(At top of Taverners Hill)



This drawing shows all the essential features of the simple enlarger. Note the baffle plates to prevent light leaks through the ventilation slots. The globe should be one designed for use in enlargers and have a power of 75 or 100 watts.

than the largest negative to be enlarged. On each side of this aperture a piece of springy brass is fastened by the lower end only. These serve to hold the negative holder securely in position during the process of enlarging.

Inside the box, and on each side of the cut-out, about 1in back from where the negative will be held, are fastened small strips of wood to support a sheet of flashed opal glass. This is to diffuse the light before it passes through the negative and thus give an even distribution of light over the whole area. It is best also to use a pearl globe (about 100 watts) rather than a clear one for the same reason.

The camera is moved back and forth to focus the image and to facilitate this it is held firmly by two lengths of wooden beading, the inside surfaces of which are lined with thin felt or cloth to prevent the camera being scratched or marked.

A light switch could be incorporated in the baseboard, but this is not essential. Instead, set the shutter at time exposure, and, when making the enlargement, merely trip

(Continued on Page 96)

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Eng. 0-40 Ammeters, 2½ Dial AC-DC 42/-
English 0-50 Ammeters, AC-DC .. 42/-
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Eng. 0-500 Micro Ammeter M/coil 37/6
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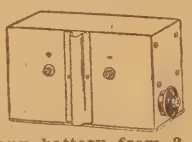
Eng. 0-50 volts 3½in Dial. AC-DC .. 75/-
Eng. 0-40 Voltmeters M/coil 25/-

COMPLETE BATTERY CHARGER

Fitted with brand new English Selenium Rectifier.



Work off 230v. AC Household Supply.

Charges any battery from 2 to 6 volts at 4 amps. £6/15/-, complete.

Another Lucky Repurchase! American Elgin 8-day aircraft clocks.

FIT ONE TO YOUR CAR OR TRUCK

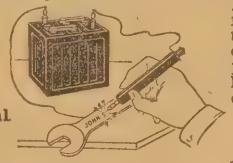
£5/5/-

The name of Elgin is world renowned and made by the best manufacturer in America.

ELECTRIC ENGRAVER

What everybody has been waiting for. An Electric Engraver that works off your car battery.

Engraves anything in metal



Ideal for name tags, dog collars, plant labels, etc.

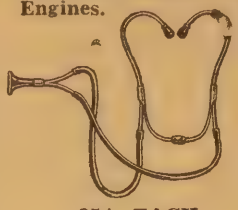
29/6

Engrave your name on all your tools. Marked tools are never stolen. No Garage should be without one.

Replace those broken side curtains with cellulose acetate which takes the place of celluloid and lasts four times longer. Will not discolor, 32/6 sheet.

Non-inflammable acetate sheet is recommended for all types of side curtains. Sheets are 1.20 thousands thick. Size of sheet, 24in. x 52in. Can be sewn or cemented into frames.

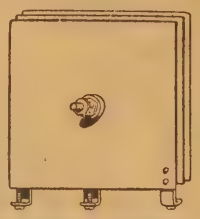
MECHANICS' STETHOSCOPES. Ideal for Testing Engines.



35/- EACH

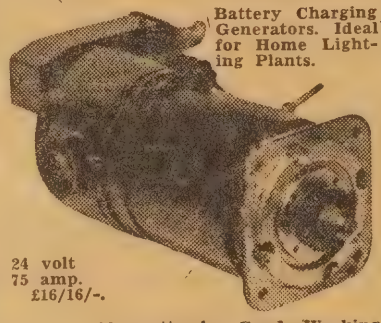
BRAND NEW ENGLISH RECTIFIERS

Make yourself a Battery Charger.



12v. 2 amp 35/-
6v. 5 amp 50/-
12v. 5 amp 79/6
6v. 2 amp 24/6
12v. 3 amp 45/-
6v. 4 amp 45/-

Transformers to suit above Rectifiers, 2 amp, 37/6. 6 volt 5 amp, 45/-. 12 volt 5 amp, 57/6.



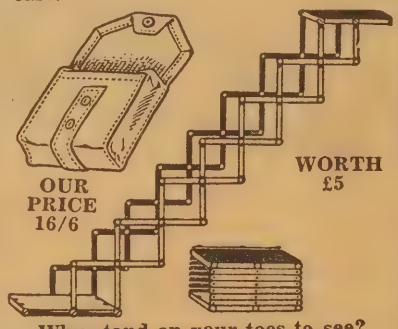
Battery Charging Generators. Ideal for Home Lighting Plants.

24 volt
75 amp.
£16/16/-.

12-volt 500 watt, in Good Working Order £5
12-volt, 500-watt, as new £10/10/-
24-volt, 1000-watt. Brand New, £12/10/-

GENUINE ARMY PERISCOPES

See over any crowd. Fits in your pocket. Complete with carrying case.



OUR PRICE 16/6

WORTH £5

Why stand on your toes to see?

AMERICAN VACUUM or AIR PUMP

Builds up air pressure to 20lb at 1000 R.P.M. Develops up to 120lb of hydraulic pressure, will pump 7½ gallons S.A.E. oil or other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems. £3/15/-

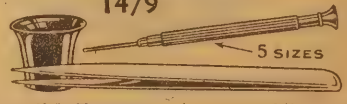
SPECIAL OFFERS

GARAGEMEN'S SPECIALS
Generator Test Meters 35-0-35 amp meters 4½in dial 45/-. 0-10 volt meters 4½in dial 45/-.
Loading Resistors can be supplied to make volt meter read 10-20 at 12/6 extra.

Swiss Music Box Units can be fitted into any type of box. Make yourself a music box. Tunes available: Whistle While You Work; Home, Sweet Home; Happy Birthday To You; When Irish Eyes Are Smiling; Road To Gundagai, **30/-**. Medical Scalpels, many uses, photographers, etc., **6/6**. Twist Drill Sets 1/16in to 3/16in. 9 Drills for **6/9**; 1/16in to 7/32in. 7 Drills for **6/9**. Shaded Pole Induction Motors, made by Hoover, of England, 230 volts, A.C. Ideal for projectors, Tape Recorders, Fans, etc., **£4/19/6**. Ball and Socket Inspection Mirrors. Ideal for Mechanics or Radio work, **8/6**. Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, **39/6**. 230 volts input. American Alemite Grease Guns. Suit all modern cars **32/6**. SAE open end Spanners, 6 Spanners to set, **24/6** set. English Low Pressure Spray Guns, **£3/15/-**. American Feeler Gauges, **8/6**. Army Steel Tow Ropes with looped ends, **17/6**. Army Tripods. Many uses for photographic work, levels, etc., 41in long, **22/6** each. Tailors' Shears, 8in., **15/-**; 9in., **17/6**; 10in., **22/6**; 11in., **27/6**; 12in., **33/6**; 13in., **37/6**. American Heavy Duty 10in. Dividers, **10/6**. American Radius Gauges, **9/6**. 4in. Calipers, inside and outside, **5/6**.

WATCHMAKERS AND INSTRUMENT MAKERS

14/9



English Tweezers .. .. 6/6 and 5/6
English Pin Vises 7/6
Eyeglasses .. .. 6/6 and 8/6
Extra strong double lens Eyeglass, 15/-
Small Screwdrivers, 2/6. Large .. 3/6

ENGLISH MOTOR AND BLOWER, 24 VOLTS

39/6

Will Work off 32-volt Lighting Plants.

Larger size also available that will work off 12 or 24 volts, £3/15/-.

STORES

512 Elizabeth St., Melbourne, C.1.
'ictoria Street Phone FJ5904

ınd Efficiently Despatched
Include State in Address

Canvas and Leather Rifle Cases .. 15/-
Battery Charger, will charge any 6 or 12 volt batteries. £7/15/-

Airplane Wheels, complete with hubs, size 10½" diam. x 4" wide. Brand new. including tube, £5/17/6. Ideal for hand trucks, wheelbarrows, etc.

SPECIAL OFFERS

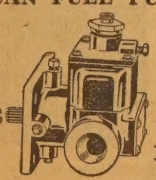
NEW DEPARTMENT SPECIALS
All wool Army blankets 32/6.
Heavy duty Army boots 39/6 pr.
Officer type boots ... 52/6 pr.
Jungle green herringbone self-supporting trousers 39/6 pr.
All wool travelling rugs 55/- ea.
Please quote size of trousers or boots when ordering.

Parabolic Reflector Mirrors, 3½in., 15/-; 10½in., 39/6. Build yourself a Spotlight or useful for photographic work.

Whit. Tube Spanners. Set 3 Spanners and Bar, 11/9 set. 12in. Steel Rulers, double side, 4/6. 6in. Steel Rulers, 2/6. 2-foot Folding Steel Rulers, 5/6. 1-foot Folding Steel Rulers, complete in leather carrying pouch, 5/6. English Headlamps, Black and Chrome finish, 6 or 12 volt. Complete with Globes, £6/15/- pair. Whitworth Socket Sets, 6 sockets and lever bar, 13/6 set. Whitworth Spanner Sets open one end, ring the other, 25/- set. 6 spanners to a set. English Hair Clippers, first-grade quality, 17/6 pr English 230 volt A.C. Relays, 50/- Genuine English R.A.F. Flying Helmets, 35/-. Speaking Tubes to fit helmets, 50/-. R.A.F. MK8 Goggles, 18/6 pr. Paint brushes, pure bristle set in rubber 1½in 5/6, 2in 7/6, 3in 13/6. Stock and Die Sets, ¼in, ¾in and 1in water pipe sizes, £5/10/-. Sport Binoculars, wonderful value, 55/- pr. Radio Power Transformer, 385 volts centre-tapped 6.3 and 5 volt filaments, new, 27/6. New 6in Permag. Speakers, 25/-.

AMERICAN FUEL PUMPS

USED BY THE R.A.F. STAINLESS STEEL VANES



WILL PUMP ANY LIQUID

400 galls per hour. In excellent order, 55/-. Brand new, 75/-.

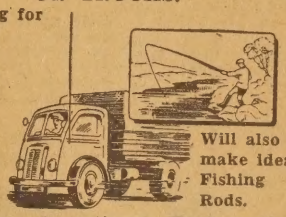
ENGLISH ARMY SPOTLIGHTS

IDEAL FOR SHOOTING. FIT ONE TO YOUR CAR.

6-volt, 37/6. 12-volt, 25/-.
Fitted with Mirror Reflector.

STEEL ARMY TANK AERIAL RODS WILL MAKE IDEAL RADIO AERIALS FOR CAR OR TRUCKS.

Too long for postage, advise nearest railway station.



Base to suit Aerial, 9/6 EACH.

Will also make ideal Fishing Rods.

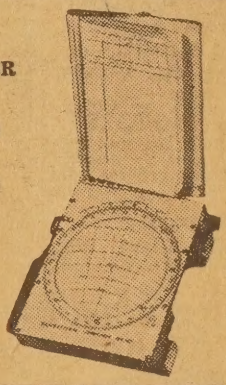
12ft. long, 3 sections. Each section 4ft., 22/6. 8ft. long, 2 section, 15/-.

IN FIRST-CLASS ORDER

DALTON COMPUTORS IDEAL FOR AERO CLUB, A.T.C., ETC.

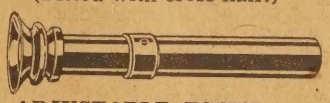
Only Limited Stocks Available. Be early.

45/-

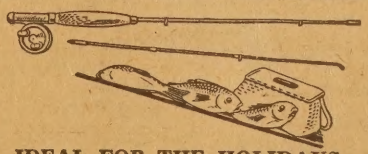


ARMY FOCUSING TELESCOPE

Easily converted for use on dumpy levels.
Can be used as a rifle sight.
Excellent magnification £4/19/6
(Fitted with cross hair.)



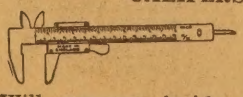
ADJUSTABLE FOCUS.



IDEAL FOR THE HOLIDAYS

2-Piece Steel Fishing Rod .. 15/6
Bakelite Reel 12/9

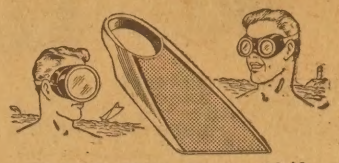
BRAND NEW VERNIER CALIPERS



22/6

Will measure inside and outside. Can also be used as Depth Gauge. Ideal for all types of engineering work. Measures in inches and m/m.

UNDERWATER SWIMMING AIDS AS USED BY ARMY FROGMEN



Goggles 25/-. Masks 22/6. Fins, large size, 8-10, 45/-; medium, 6 to 8, 45/-; small, 3 to 5, 32/6. Junior size, 25/-.

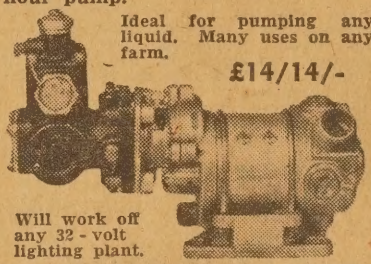
How is this for value: GENUINE SWISS GENTS' WRISTLET WATCHES

Genuine Leather Wrist Strap, 79/6. Expanding Chrome Band, American Style, £4/4/-.

Lucky Repurchase! Aircraft 24 volt motor complete with 400 gal. per hour pump.

Ideal for pumping any liquid. Many uses on any farm.

£14/14/-



Will work off any 32 - volt lighting plant.

Be early! Limited quantity available.

BRAND NEW AIR COMPRESSOR

2.2 cubic feet, will pump up to 75lb.

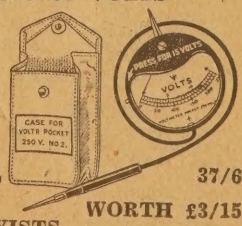
Never before at this price. Ideal for Spraying.

£11/15/-

Will work off ½hp Motor.

AT LAST! British Army Issue DOUBLE SCALE VOLTMETER 0.15 0.250 VOLTS

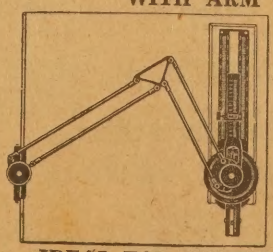
IDEAL FOR BATTERY SET USERS AND DEAF AID USERS OR HOBBYISTS



37/6

WORTH £3/15/

R.A.F. PLOTTING BOARD WITH ARM



Bakelite Base. Draws Angles Parallel or Vertical.

70/-

IDEAL FOR ENGINEERS, STUDENTS, ETC.

WALTHAM TRADING CO.

SEND FOR OUR FREE ILLUSTRATED BARGAIN CATALOGUE OF GENERAL MERCHANDISE.

319-321 SWANSTON STREET—303 FLINDERS STREET.
Address all Mail Order correspondence to: Box 5234, G.P.O, MELBOURNE.

SEND FOR OUR FREE CATALOGUE OF RADIO AND RADAR EQUIPMENT.

MILLIAMP METERS

0 to 1 Milliamp Meters, 2in. Moving coil type.

£1/7/6

Postage and Packing: Vic., 4/-; SA, NSW, Tas., 5/-; Qld., WA, 5/6.

INSTAL YOUR OWN BURGLAR ALARM

by fitting Micro Switches

Micro Switches are compact precision snap switches, small and easily concealed. The slightest movement of door, window will bring the switch into operation.
These Micro Switches are easily installed, and a circuit diagram is supplied free. They can also be adapted for many other useful purposes where a precision snap switch is required.
CLEARANCE PRICE: Three for 22/6. Post Free.

USEFUL KITS OF PARTS FOR HOME CONSTRUCTORS

No. 1 CONTAINS
2 Key Switches
2 Co-ax Connectors
1 reel Dial Cord
1 2 mf Condenser
1 .5 mf Condenser
1 4 mf Condenser
4 Shock Mounts

22/6 POST FREE

No. 2 CONTAINS
2 ½ meg 1 watt IRC Resistor
2 1 meg 1 watt IRC Resistor
3 1204 RF Pentode 6 volt Valves and Sockets
1 Telephone Jack, DC closed circuit
1 Bakelite Toggle Switch
1 single Bank Rotary Switch, 5 position

22/6 POST FREE

No. 3 CONTAINS
6 Terminals
1 Telephone Jack
2 Co-ax Connectors
1 reel Dial Cord
4 Shock Mounts
2 ½ meg Resistors
2 1 meg Resistors
1 Bakelite Toggle Switch
1 Single Bank Rotary Switch
1 Key Switch

1 M/C CRYSTALS

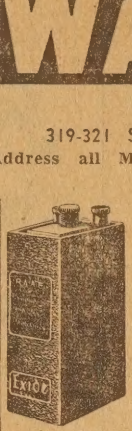
Suitable for Crystal Calibrators. £2/-/-
Postage and Packing: Vic., 3/6; NSW, SA, Tas., 4/-; Qld., WA, 4/6.

FLAT TWIN WIRE

Rubber and cambric insulated. Made by Olympic. For car and truck wiring.

52/6 per 100-yard reel

Postage and Packing: Vic., 6/-; NSW, SA, Tas., 8/6; Qld, WA, 11/-.



LEAD ACID ACCUMULATORS

Type B. 2 volt 20 amp hours. Made by Exide. Size 7in x 3½in x 2½in. Weight 3½lbs.

3 for 30/-

Postage and Packing: Vic., 7/6; NSW, SA, Tas., 10/6; WA, Qld., 14/3.

HIKING COMPASS

A practical compass in a bakelite case 2½in. x 2½in. with thumb ring. Calibrated with luminous markings for night use. Invaluable for hikers. Price £1/9/6.
Postage and Packing: Vic., 4/-; NSW, SA, Tas., 5/-; Qld., WA, 5/6.

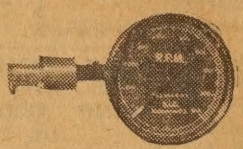
19 Volt MOTORS

Laminated field for use with AC or DC supply. Approx. 1/10 H.P. Good general purpose motor for low voltage systems.

£1/19/6

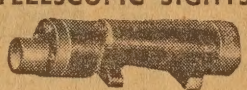
Postage and Packing: Vic., 5/-; NSW, SA, Tas., 7/-; Qld., WA, 8/6

REV. COUNTERS



0-900 r.p.m. 6in dial, ⅜in inside diameter on coupling. Made by Synchrotac of Melbourne. Price £7/10/-.
Postage and Packing: Vic., 6/-; NSW, SA, Tas., 8/6; Qld., WA, 11/-.

PRISMATIC TELESCOPIC SIGHTS



Can be converted for use as rifle sight, surveyor's sighting telescope and many other uses where first-class lenses are required. Length 5½in. Eyepiece lens 1in., front lens ¾in., eye refief 3in. Weinght 15 ozs. Price £3/10/-.
Packing and Reg. Postage: Vic., 5/-; NSW, SA, Tas., 6/3; Qld., WA, 7/-.

FLYING HELMETS

Suitable for motor cyclists. £1/15/-.
Postage and Packing: Vic., 4/-; NSW, SA, Tas., 5/-; Qld., WA, 5/6.

BUILD YOUR OWN ELECTRIC LIGHT AND POWER PLANT

Aircraft Generators

12v 500w brand new £7/10/-
24v 500w brand new £11/15/-
24v 1000w brand new £12/15/-
24v models can be used as 32v without alteration.
24v-750w brand new American Bendix complete with double V pulley 3½in. . . . £19/15/-0
100v 600w . . . £15
50-0-50 Ammeter, moving coil . . . £2/10/-
Postage and Packing on Ammeter: Vic., 3/6; NSW, SA, Tas., 4/-; Qld., WA, 4/6.

3½in V Pully to suit 12 and 24v models . . . 35/-
Postage and Packing: Vic., 3/6; NSW, SA, Tas., 4/-; Qld., WA, 4/6.
12v Cut-out . . . 15/-
3/6; NSW, SA, Tas., 4/-; Qld., WA, 4/6.

Regulator & Cut-out

Suitable for use with 24v and 32v Generators, or as tractor spare. Made by Bendix of U.S.A. Price, £4/19/6. Reduced £3/10/-.
Postage and Packing: Vic., 5/-; NSW, SA, Tas., 7/-; Qld., WA, 8/6.

THROAT MICROPHONES

Magnetic type, high output. Can also be used as contact microphones on musical instruments. Comprises two microphone units which may be used separately. **12/6**

Postage and Packing: Vic., 4/-; NSW, SA, Tas., 5/-; Qld., WA, 5/6.

All goods consigned freight payable on delivery unless otherwise stated.

Sorry no C.O.D.

ELBOW TELESCOPES

English Elbow Telescopes with approx. X6 magnification, extra wide field of vision, 11in. long and 5½in. high with an Eye relief of 1in. Price, £3.
Postage and Packing: Vic., 6/-; NSW, SA, Tas., 8/6; Qld., WA, 11/-.

HAND BEARING COMPASS

A beautiful and extremely accurate instrument. Liquid damped. Adjustable reading prism, complete with torch handle, for standard battery, illuminates card for night use, packed in Transit Carrying Case. Easily worth three times the price. £7/10/-.
Postage and Packing: Vic., 5/-; NSW, SA, Tas., 7/-; Qld., WA, 8/6.

VALVES

1204 RF Pentode 6 volt Valve and Socket	3/11
EF 50	12/6
186	7/6
1K5	5/-
VT.61	10/-
6A6	10/-

Plus Postage and Packing.

TANNOY MICROPHONES

Exceptionally high output. Eight button.

12/6

Postage and Packing: Vic., 4/-; NSW, SA, Tas, 5/-; Qld., WA, 5/6.

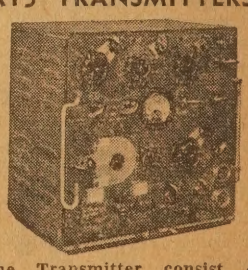
BENDIX LOOP AERIAL RA. IOFA

Incorporating a rotating mechanism and reduction gear with a 9 inch loop.

15/-

Postage and Packing: Vic., 6/-; SA, NSW, Tas., 8/6; Qld., WA, 11/-.

AT5 TRANSMITTERS



The Transmitter consist of two separate sets of tuning circuits, M/F covering from 150-500 K/cs and HF covering from 2-20 M/cs. The same valves are used on both ranges and the change of LC circuits etc., from M/F to H/F is effected by a single switch. Thus one pre-set M/F and one pre-set H/F is available at all times.
Valves — Commercial types are used as indicated:
H/F Oscillator . . . 6V6G
H/F Buffer-Double Amplifier —M/F Oscillator . . . 807
Power Amplifiers . . . 2—807
Modulators 6V6G **£12/10/-**

SPECIAL QUOTATIONS FOR LARGE QUANTITIES

ANSWERS TO CORRESPONDENTS

W.F.S. (Fairfield, NSW) raises a few estions about transformers, valve types d push-button tuning.

A: There is little you can do, W.F.S., out using the 110 volt primary trans-rmer. Do not connect it across the volt power mains, as you would no ubt burn it out. There is no point using a 240 volt to 110 volt trans-rmer for the purpose, unless you have e on hand, as its purchase price is not ich different to that for a standard 240 t primary power transformer. The H7 valve can be used quite success-lly in audio frequency work. Its aracteristics are very similar to the niature 6AU6. It is a sharp cut-off e. It was used as a microphone pre-plifier in the Home Recording Amplifier the May, 1952 issue. The plate load sistor was .1 megohm, the screen resistor megohm and the cathode resistor 500 ms. Note that these values differ m the usual values of resistors for a wer gain 6J7 or 6C6 valve. Push-tton tuning could be arranged with TRF tuner if you could provide the echanical switching of three pre-set pacitors for each station which you sh to tune. The pre-set capacitors uld be the adjustable padding capacitors you could use fixed mica capacitors mewhat near the required value and ought to the exact value with a 3-30 pf r trimmer or a 50-50 pf compression immer paralleled across it. Whatever proach you adopt, you will need ite a number of these preset capacitors you want to tune to the eight local ations. A dial mechanism incor-rating push-button setting of an ached gang was available at one time. co Manufacturing Co. would be able to vise on its present availability. A 9 tt amplifier employing push-pull 6V6GT lves was published in the August, 1948 ue of Radio and Hobbies. It is called e Guitar Amplifier. It used two 6SJ7GT lves ahead of the 6V6GT's. One or both these could be replaced by the 6SH7 e with the plate, screen and cathode sistors changed to the values mentioned ove. Another amplifier of this type the Playmaster Amplifier No. 2 des-bed in the November, 1951 issue. Details these amplifiers can be obtained through e 2/- Query Service. Information on s Service is given in the panel on these ges of Answers to Correspondents.

P.M.W. (Turramurra, NSW) asks some estions about the Playmaster Amplifiers, e recording and a VTVM.

A: The use of the 58 in the Playmaster plifier No. 5 is not really a good move you say but you may be able to get ay with it for your particular use. We not feel that it would be wise to the control unit on the same chassis the main amplifier because of the pos-ility of hum troubles. This does not an that it would not be successful but u would need to be careful with lay-t and earthing and to be prepared for blems of hum and possibly instability. e convenience of having the control it as a separate item is one of its tures. The tuner could be fitted to the in chassis but here again watch for m injection into the output circuit of e tuner, particularly the whistle filter l. We are pleased to note your interest the articles on tape-recording. You uld use the 6M5 in the Tape Recorder , 1 of the November, 1952, issue pro-led that you changed the bias resistor 175 ohms. It would be wise to insert 5000 ohm resistor in series with the con-ction to the control grid right at the cket to prevent possible parasitic oscil-ions prevalent under certain conditions th high Gm valves. With certain servations, the 6AU6 valves could be placed by 6N8 valves without change component values. There will be a s of overall gain. We will analyse your dified circuit of the multimeter and y find space for it in the Reader Built page. With reference to the VTVM cuit, we suggest that you turn to page of the August, 1945, issue of Radio and bbies where you will find a circuit ilar to the one you enclosed but with e added advantage of standing current ncellation. Details are also given in e text for the calibration of the meter. e VTVM will cover readings of AC over the whole audio spectrum and into portion of the RF spectrum. Where lead capacitance becomes troublesome in the RF region an RF probe can be attached.

W.S.F. (Burwood, NSW) writes to suggest that we describe a means of using the various Playmaster amplifiers for tape recording and also describes his own disc recording gear.

A: Yes we have thought of this idea W.S.F., but it involves a good deal of extra circuitry. A considerable amount of frequency compensation is required, plus the high frequency bias. However, we have the idea in mind and may do something along these lines fairly soon. Many thanks for your description of your disc recording equipment, which should be capable of very good results.

H.M. (Stanthorpe, Q) sends us a photograph of an electronic flash unit which he recently built and which is giving very satisfactory service.

A. Many thanks for the photograph, H.M., and we are pleased to hear that you are getting successful results from the unit. We think you will find that the results from the use of D76 developer will be much improved and, providing the grain is not objectionable for your particular requirements, would probably be a good standard developer. We would be pleased to learn of your results in this regard, particularly on 35mm.

E.E.M. (Glen Iris, Vic.): Writes to express his appreciation of Radio and Hobbies and in particular the articles on the multimeter, the Electronic Flash Unit, and tape recording. Regarding the multimeter he suggests that we feature an additional article covering the fitting of AC current ranges.

A. Thanks, E.E.M., for your kind remarks about the magazine and we are glad to hear that you find the various articles so useful. We have not had many demands for meters with AC current ranges, but we will keep the idea in mind for possible use at a future date. In the meantime we suggest you contact some of our advertisers who specialise in test equipment and who should be able to assist you in the matter of the necessary current transformer, together with details of how it can be used with your particular instrument.

P.J. (Coonamble, NSW): Sends us a letter for the Serviceman Who Tells in which he criticises some of the practices current among servicemen of his acquaintance.

A. Thanks for your letter, P.J., and we have passed it on to the serviceman for possible comment in a subsequent article. The whole problem seems to hinge on the question of the general competence of individual servicemen and is probably no different from that experienced in many other skilled trades. At the same time the point is an interesting one and it may well be that the general level needs to be raised.

J.D. (Milgildie, Q) asks whether it would be possible to use a portable or mantel set as a signal tracer and whether the RF portion of one of these could be used as a signal generator for the RF portion of the defective set. He also inquires whether all valves show a visible light when operating.

A. It is true that a receiver can be used as a signal tracer and, in fact, most signal tracers bear some resemblance to a receiver. However, such devices must either be untuned in order to cover all frequencies likely to be encountered in the set, or capable of being tuned over a wide range of frequencies. An ordinary set does not provide these requirements. The RF portion of a set cannot in any circumstances be regarded as a signal generator, and we think you are a little off the track in this regard. The filaments of all valves give off some light when they are operating but this does not mean that the light is always visible. The amount of light given off by a battery valve is very low, while the construction of the valve often makes it very difficult to see the filament. It is often necessary to view the valve in very dim light in order to see any sign of light. The fact that your valve tests correctly would suggest that the fault is in some other part of your set.

D.S. (Bald Hills, Q) wants us to publish a list of milliamps or microfarads and other measurements used in radio service.

A. We are not quite sure exactly what information you require, D.S., but it is probable that values of current and voltage to be found in various parts of a receiver is what you have in mind. If so, this is rather a difficult problem, since values can vary over a fairly wide range in different receivers. The matter was covered in one of the "Learn While You Build It" series published in June, 1952. A few copies of this issue are still available from this office if your own files are not complete.

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ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required, must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

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To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

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SELL: Mini-max AC portable less valves. Misc. parts. Offer. 14 Elmie St., Hawthorn, Melbourne. WA1647.

SELL: Type A Mk III transceiver, cathode modulated, separate AC power supply, 6in speaker, £12. 3BZ transmitter, £20. Lang, Titanga, Lismore, Vic.

WANTED: AT10 or equiv. 12-volt power supply. Lang, Titanga, Lismore, Vic.

SELL: Microgroove recorder, 1 hour one side 10in record. Perfect. See working. With output meter and two cutting sapphires, £40. FJ2134. Browne, 4 Tucabia St., Coogee.

WANTED: Telephone set, battery operated. Must be in good order. For sale model OK1 University oscillator and class C wavemeter. Write W. G. Coward, Wandoona, Moree, NSW.

WANTED: 1196 receiver and cover for 1196 xmtr. Black, George Street, Liverpool.

WANTED: Manual or instructions for AR7 receiver, Funk, 5 Everton Rd., Strathfield.

WANTED: 16mm sound and silent film, preferable suitable native audiences. Details to T. A. Wyborn, Daru, Western Division, Papua.

WANTED: Valve and circuit tester. Cash to £25/-/-. Reply 19, Antwerp St., Auburn, R. Harrison. (UU1700.)

RADIO TECHNICIAN wants to help you building your rig or receiver set, 9/- per hour. Please write, Box 6, P.O., Guildford, NSW.

ANYONE CAN BUILD THIS SET

(Continued from Page 55)

lug earthing to the set chassis. The is no particular significance attach to this except that when the speak transformer is mounted on t speaker, as in this case it can h to clear up the last traces of aud instability.

It has to do with capacitive effe of the large mass of speaker fra to other parts of the circuit wh the speaker is mounted below t set in a cabinet. Additionall earthing one side of the voice c of the speaker to the speaker fram and hence back to the set, is anoth "dodge." We don't expect you have any trouble in this directio however.

Provision is made for a high ou put type of pickup such as the cr stal. When you want to use the pic up, simply disconnect the wire brid between two of the three termina the pickup being connected betwe the earth terminal and the cent one.

You will no doubt take the eas path and use the crystal pick-u direct into the set for the tim being. After all, that's how mo pickups are used with commerci sets these days. As time wears o and you become more familiar wit the set, you may like to go a ste further and play around with com pensation for the pickup for th differing recording characteristics the 78 and LP recordings.

When you get to this stage, tur back to this issue and look up th index for the reference to the "Crys tal Pickup Preamp." This is a litt outboard unit which does rather in teresting things with the respons curve of such pickups and mak their reproduction from discs mo pleasing to the discerning ear.

A SIMPLE PHOTOGRAPHIC ENLARGER

(Continued from Page 91)

open the shutter for the required time.

The negative is held in a cardboard folder with the necessary aperture cut in it and the image of the negative is projected and focused on to a sheet of white paper pinned to the darkroom wall, a small easel, or a special stand attached to the end of the baseboard. It is best to have this stand fitted to the baseboard in a manner similar to the camera, so that its distance from the negative can be varied.

In the latter case the lamp-house and camera would need to be raised to a somewhat higher level than the baseboard so that the image would not foul the latter in reaching the stand. Three to four inches should suffice. In any case, see that the stand is rigid and upright.

When the image has been carefully focused, close the shutter, place a piece of cloth over the whole apparatus to prevent leakage of light, and check the image again to see that the cloth is not fouling the negative or front aperture. If all is well, close the shutter or switch off and, working by a suitable darkroom lamp, substitute a piece of bromide paper for the white paper on the stand.

Mr. Jones' original contribution also contained details of the actua process of making the enlargemen and the handling of bromide papers This followed the same general prin ciples as have already been covere in earlier articles (Radio and Hobbies March, 1952), and we suggest tha readers who may be a little rust on this point refer to these articles

Although a box camera is speci fied there is no reason why a fold ing type should not be used an these normally have superior lenses If a folding camera is to be use it will be necessary to mount it o some form of support, such as block of wood. Modern types, wit self-erecting fronts, will have t be moved back and forth in th same manner as the box type, whil the older type may be focused b sliding the lens mount on its run ners.

In place of an ordinary froste globe it would be better to use proper opal enlarging globe such a are readily available from photo graphic stores. The flashed opa glass may be purchased from th same source.

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